

MEDICAL EXTRACTS:

ON THE
NATURE OF HEALTH,
WITH
PRACTICAL OBSERVATIONS:
AND
THE LAWS
OF THE
NERVOUS AND FIBROUS SYSTEMS.

BY
A FRIEND TO IMPROVEMENTS.

VOL. II.

A NEW EDITION.

Robert John Thornton

Homines ad deos in nullâ re propius accedunt, quam salutem
hominibus dando.

CICERO.

LONDON,

Printed for J. JOHNSON, St. Paul's Church-yard; and
ROBINSONS, Paternoster-Row:

And sold by them, and DILLY in the Poultry; MURRAY, Fleet-street;
MANSON, Pall Mall; OWEN, Piccadilly, opposite Bond-street;
and Cox, St. Thomas's-street, Borough.

1796.

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WILLIAM D. R. WEAVER

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TO
D R. D A R W I N.

PHYSICIANS often lament, that their patients will not pursue the directions given them; and indeed, when their sense is not persuaded, it is no wonder they are tempted to follow their own fancies. It is presumed, that those, who will be at the trouble to peruse the following pages, will see abundant reason for the injunctions frequently given them by scientific practitioners, respecting *food, air, exercise, diversions, &c. &c.* and having acquired a knowledge of THE NATURE OF HEALTH, and THE LAWS OF THE ANIMAL OECONOMY, they will also be able to distinguish the Practitioner of *modest merit* from the *Quack*, who wades in darkness, and tries his *specific remedies* one after another, until the patient recovers

more by accident, and the efforts of Nature, than any thing else, or can tell no tales. This part of the work, I am led to think, will be also amusing to the philosopher, who considers the study of the human frame a part, and the most interesting part, of natural history. It may prepare the student for the more careful study of your incomparable work *, which, had it appeared sooner, would have earlier enriched this volume, and the discoveries of Dr. JOHN BROWN would have been *also* attributed to you, as they were made *previous* to his, though not published to the world, as many of your friends can attest.

I HAVE THE HONOUR TO BE,

WITH THE HIGHEST RESPECT AND ESTEEM,

&c. &c.

* *Zoonomia, or the Laws of Organic Life.* Two Vols. Quarto.

IT is truly mortifying to observe the *slow progress* of IMPROVEMENTS, and to hear the *absurd objections* made to them, and that not unfrequently by people of the best sense and education. His late *Majesty* wished to have the streets of LONDON and WESTMINSTER paved in the *present way*; but on advising with some Scotch physicians, they said it would be very hurtful to the health of his *Majesty's* good citizens of LONDON, who had little time to spare for the taking of exercise, and that the jolting of a coach for one mile over the stones did more service than the travelling of several miles on a better road. His *Majesty* had too great a regard for his people to countenance any thing that would injure their health, and so it was dropt.—However several Londoners, who had been witnesses to the superiority of the streets in EDINBURGH, were resolved about thirty years back to make the trial; and, I am creditably informed, that *York* and *St. James's* were the first streets that were paved in the NEW WAY, and the *mob* were so displeased, that what was laid down in the *day* they pulled up in the *night*. Amongst other objections, they said the stones were so small they could not bear the weight of the carriages, and so smooth the horses could have no footing, and that trade would be ruined. It was in vain to tell them, that the city of EDINBURGH had been paved in that manner near an hundred years back. The night-watchmen, however, being increased, and this trial succeeding, it became universal, and many other cities and towns adopted it, and I believe nothing now would induce them to submit to have the streets paved in the OLD WAY. In RUSSIA, prejudice is so strong, that, though large premiums have been offered to the carpenters, the *saw* has not *as yet* been able to be introduced!—DONALDSON. COX.

the day the nation was first able to be united. — DONALD BROWN. (2)

PART III.

**THE
RESTORATION OF SUSPENDED ANIMATION.**

NATURE OF HEALTH:

**AND
THE LAWS
OF THE
FIBROUS SYSTEM.**

An Extract from Dr. LETTSOM's Oration, when presenting the *Prize Medal*,
Adjudged to Dr. FOTHERGILL of BATH,

FOR HIS
DISSERTATION
ON THE
EFFICACY OF VITAL AIR
IN THE
RESTORATION OF SUSPENDED ANIMATION.

A long series of years is often required for the admission of NEW TRUTHS. It was thought audacity in M. FAGON to defend the *Harveian Discovery*, near forty years after the first promulgation of it in England. So COLUMBUS, when he first divulged his vast project of *doubling the globe*, was insulted by INCREDULITY; and, after he had added a *new* to the *old hemisphere*, was persecuted by ENVY. In like manner, when the northern Luminary, LINNÆUS, created a *new system* of vegetable nature, he found on every side *determined assailants*; but, fortified by the energies of his capacious mind, he gave this reply,

"POSTERITY WILL DECIDE;"

and, pointing to some academic children at play—"These," added he, "*will become our judges.*"

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AND THE

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- 2d. A PECULIAR LIGHTNESS of the Chest, - - - - - ib.
- 3d. A GENIAL and EXTENSIVE WARMTH.
- 4th. A GREATER FLOW of SPIRITS than usual.
- 5th. By degrees his COMPLEXION from an UNIFORM BROWN became FAIRER, and SOMEWHAT FLORID.
- 6th. His FINGERS had a CARNATION TINT.
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{In America a TRIBE of INDIANS flatten the Forehead, and file all the front Teeth to a Point, - - - - -	ib.
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{ The EVILS which *arise* from *this Fashion*, - ib.

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{ A very *striking Example* of THIS TRUTH, - - - - ib.

{ From the *unsettled State* of the *Weather* in
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{ These prove *fatal* to *thousands* every Year, - ib.

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{ WARM CLOTHING *recommended*, - - - - ib.

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{ The *Superiority* of the FLEECY HOSIERY to FLANNEL, ib.

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{ <i>JONAS HANWAY</i> , who was in a Decline, recovered his Health by going to <i>Holland</i> , -	ib.
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{ Dr. BUCHAN's Work *censured*, as the *just Ap-*
plication of *Remedies* requires *more Study*
than the *Readers* he designs his Work for
are *capable of*, - - - - - ib.

{ A Note illustrative of the *Nature* of PERSPIRATION.

1st. It is 2 *Parts* FIXED AIR.

2d. ——— 1 *Part* AZOTIC AIR.

3d. ——— WATER, impregnated with SA-
LINE, and OTHER MATTERS.

{ The *Absorbents* of the Skin imbibe OXYGEN,
or VITAL, AIR, even *separating* it from
atmospheric Air.

{ Does the *same Analogy* hold with regard to
THE LUNGS?

{ This *Question* will be attempted to be *answer-*
ed by Experiments instituted by Dr. BED-
DOES and Dr. THORNTON, - - - - - ib.

OF MENTAL STIMULI.

SECT. XIV. OF VISION.

{ LIGHT is said to be *refracted*, when its Rays,
which would otherwise *proceed* in a *straight*
Line, are *bent inwards* by *passing* through a
denser Medium than *Air*, - - - - - 278

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{ In relation to this LAW, the *Eye* consists of
three distinct Humours of different Densities :

1st. The AQUEOUS.

2d. The CHRYSTALLINE.

And 3d. The VITRIOUS, - - - - - 278

{ Of the DARK MEMBRANE which lines the
Eye, - - - - - 279

{ Of the OPTIC NERVE, and its oblique Termination in the Brain, - - - - - ib.

{ This is adduced as a signal Instance of the beneficent Intention of our DIVINE CREATOR, - - - - - ib.

{ Of the PUPIL, - - - - - ib.

{ Of the IRIS or UVIA, and its Action, - - - - - ib.

{ THE FIBROUS TEXTURE of this Part of the Eye demonstrated by Dr. HAIGHTON.

{ ITS SYMPATHY with the Optic Nerve.

{ The Sympathy of other Parts also shewn, - - - - - ib.

{ The SIX MUSCLES of the Eye, - - - - - 280

{ A Description of these, and their Actions, - - - - - ib.

{ The Benevolence of the CREATOR with regard to Brutes in giving them a seventh Muscle, - - - - - ib.

{ The Image of Objects is painted on the RETINA and conveyed to the Brain by the OPTIC NERVE, - - - - - 281

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{ The *Impression* cannot arise from VIBRATION,
or the MOTION of an INERT FLUID, - - 281

{ It must arise therefore from some SUTLE
AGENT, and the *Instantaneousness* of the
Propagation of sensible Impressions and mus-
cular Motion indicates an Analogy between
THIS FLUID and the ELECTRIC FLUID, - ib.

{ A Sixth Part of the Blood goes to the Brain
OXYGENATED and returns thence UN-OXY-
GENATED, and it is inferred that the Brain
converts the *disengaged Caloric* into the
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{ The MIND is seated in the Brain, - - - - ib.

{ The Reflection which this Idea naturally sug-
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{ The EXTERNAL EAR, - - - - - 283

{ The CANAL or PASSAGE leading to the inter-
nal Ear, - - - - - ib.

{ The WAX is designed as a defence of this
Part, - - - - - ib.

{ At the Extremity of this Canal is a MEM-
BRANE dividing the external from the in-
ternal Ear, - - - - - 284

{ The Structure of the internal Ear.

1. The TYMPANUM or DRUM, - - - - ib.

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{ From <i>this Part</i> there is an <i>opening</i> called the	
EUSTACHEAN TUBE, - - - - -	284
{ Its <i>Office</i> , - - - - -	ib.

{ This <i>Tube</i> is <i>closed</i> , when we are in the act of swallowing,	
by the <i>UVULA</i> , which also prevents the Food from	
passing into the <i>Nose</i> .	
{ The <i>merciful Wisdom</i> of PROVIDENCE is conspicuous in	
this Instance, as <i>Brutes</i> , who are prone, and therefore	
not subject to have any of their Aliment pass through	
the <i>Nose</i> , want this <i>Defence</i> , - - - - -	ib.

{ Within the *Tympanum* or *Drum* there are

2. FOUR SMALL BONES.

{ These *communicate* with,

3. THREE BONY and WINDING CAVITIES, lined in the Inside with,
4. NERVOUS FILAMENTS, which unite into a common Trunk, and go to the Brain.

{ The <i>Tympanum</i> and its <i>four Bones</i> supposed to	
be the immediate Organs of hearing, -	285

{ These <i>Parts</i> , like the <i>Humours</i> of the Eye,	
only <i>prepare</i> the Object for the immediate	
Organ, - - - - -	286

{ The <i>benevolent Intention</i> of the ALMIGHTY shewn by the	
<i>Difference</i> in the Structure of the <i>Membranes</i> of the	
<i>Drum</i> in <i>Birds</i> and in <i>Animals</i> , - - - - -	285

{ This <i>Membrane</i> was removed from the Ears of a Dog, and	
his Hearing was not in consequence <i>destroyed</i> , - - -	ib.

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{ As a Defect in this Part of the Ear may be reasonably presumed to be a Cause of Deafness, CHESELDEN proposed to extract it, for the same Reason as the *chrystalline Lens* when in a State of Disease is *extracted* and *Sight* is restored.

{ A Malefactor, who was deaf, receives his Pardon on condition he submits to this Operation.

{ As soon as this was publicly known, THIS EMINENT ANATOMIST is insulted in the Streets, and having entered the Theatre, the Play is stopt by the Cry of *Drum! Drum!* and he is constrained by the public voice to give up the Experiment.

Such has ever been the Treatment of Men, who, from Benevolence of Heart, and a philosophic Conviction of Truth, attempt to innovate, or rather it should be said, to improve on the Routine of Things, - - - - - 286

{ The Ear has WATER confined within it, which, as being a denser Fluid than Air, is better adapted to the Propagation of Vibrations, - - - - - ib.

{ A curious Distribution of the Nerves which occasions an useful Consent of Parts, - - - 287

{ OTHER ASSOCIATIONS exist which cannot be referred to the Nerves, - - - - - ib.

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{ In <i>Animals</i> HEARING forewarns them of <i>Dangers</i> , in <i>Man</i> it is an <i>Inlet</i> to a <i>Variety</i> of <i>Pleasures</i> , - - - - -	288
{ Of the young <i>Man</i> who was born <i>deaf</i> and recovered his <i>Hearing</i> when he was <i>twenty-four Years</i> old, and an <i>Account</i> of his <i>State</i> of <i>Mind</i> during <i>this Period</i> , - - - - -	ib.
{ <i>All Nations</i> have <i>their Music</i> , - - - - -	289
{ <i>Loud Sounds</i> powerfully <i>operate</i> on the <i>Spirits</i> , - - - - -	290

SECT. XVI. OF THE TOUCH.

{ The <i>Surface</i> of the <i>Body</i> the <i>Seat</i> of THIS SENSE, - - - - -	291
{ The <i>Skin</i> is an <i>Emunctory</i> to fend out the effete <i>Parts</i> of the <i>Blood</i> , and is therefore covered with <i>INNUMERABLE PORES</i> , - - - - -	ib.
{ It is composed of <i>two Parts</i> ,	
1st. THE EXTERNAL SKIN,	
2d. THE INTERNAL SKIN.	
{ Between <i>these</i> is placed a <i>MUCOUS SUBSTANCE</i> called <i>RETE MUCOSUM</i> , (<i>the Mucous Net</i>), being <i>pierced</i> throughout by <i>NERVOUS PAPILLÆ</i> , - - - - -	192
{ This <i>Substance</i> gives <i>colour</i> to the <i>Body</i> , and forms the <i>chief Contrast</i> betwixt <i>black</i> and <i>white Men</i> , - - - - -	

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{ Dr. BEDDOES, by a chemical Process, converted the <i>black</i> Skin of a Negro into <i>white</i> ; and it is said that the <i>Reverse</i> happened to a reverend Divine in France, - -	292
{ The NERVOUS PAPILLÆ arise from the <i>external</i> Skin, and <i>every where</i> pierce the <i>mucous Substance</i> , - - - - -	ib.
{ THESE PAPILLÆ, besides <i>their Sense</i> of Pain, possess the peculiar Power of conveying to the Mind the Impression of <i>Hardness</i> and <i>Softness</i> , - - - - -	ib.
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*Matter preliminary to the Explanation of the First Law
of the Nervous and Fibrous Systems.*

THE

PROGRESS OF MEDICINE.

“ If I had foreseen all the weight of *opposition* that has arisen against me, I would have left to others the pursuit of an empty shadow—but the reflection of being of service to my fellow creatures affords a return for the inquietudes ever attendant upon literary exertions.” Vide Sir ISAAC NEWTON’S Letter to Dr. Bentley.

As long as PHILOSOPHY was built, not upon the substantial basis of actual experiment, but imagined properties, which were assumed as data, it was putting on new forms almost every day; for one fanciful opinion had always a right to supplant another. Hence the best PHILOSOPHER in those days was him who could reason most ingeniously on occult qualities, either invented by himself, or by some favourite writer.

Lord Chancellor BACON was the first who discovered the fallacy of this sort of philosophy. He rejected all that chimerical nonsense, which had usurped the name

* A

of

of philosophy, and wisely exclaimed—"Non fingendum, aut excogitandum, quid Natura feret et faciat, sed inveniendum est." That the operations of nature was not be fancied, but diligently scrutinized. Hence, in less than the space of a century, the principle of philosophizing being altered, more light was thrown upon every branch of science, than it had received for above two thousand years before.

The discovery of the *circulation of the blood* first immortalized the name of HARVEY. It may appear wonderful, and at the same time not a little mortifying to the vanity of mankind, that a motion in the frame, which constitutes the basis of life, and which chance must have made us sensible of a thousand times, should have escaped the eyes of all who imagined themselves to be observers, and some of whom were actually such. When the doctrine of the circulation of the blood could no longer be resisted, various unsuccessful attempts were then made to prove that it was known long before; so was it with COLUMBUS who discovered a new world, which occasioned him to make this simple proposal to his opposers, namely, "*to place an egg upright.*" All attempted, but in vain. This illustrious navigator then *himself* broke the end, and "*the egg stood up.*"

"*The thing,*" says he, "*is very easy when known,*" and ENVY itself was abashed. Thus attraction, the weight, and elasticity of the air, shewed themselves to the senses every day; but it required a TORRICELLI and a NEWTON to illustrate them.

The discovery of the next importance is *irritability*, a property essential to all animals, likewise to all plants, and which henceforth will justly be ranked amongst the principal qualities of all organized animated beings. This discovery confirms the more honour on Baron de HALLER, as it was made in an enlightened period, and upon a subject so much searched after as the human body. This discovery also, like the other, met at first with violent opposition, and from similar motives: INDOLENCE, to avoid the trouble of an examination; VANITY, to shun the imputation of ignorance; and ENVY, to deprive the discoverer of his praise. Hence its existence was first flatly denied; and after it was confirmed by the strongest facts, so that it was impossible for the most stubborn prepossession to challenge the truth of it, the merit of the discovery was then attempted to be wrested from the author.

In like manner the science of *chemistry* has had its revolutions, and one error succeeded to another until LA-

VOISIER established a system, which being founded upon *truth is eternal*.

Upon the broad basis of *the discovery* of HALLER*, and the *new chemistry* of LAVOISIER,—Dr. BEDDOES,—Dr. DARWIN,—and the Rev. Mr. TOWNSEND †, have raised a *new and beautiful superstructure*, such as we shall endeavour to describe in this work, and it is hoped that soon, instead of a proverbial *disagreement*, the *same consent* among *practitioners* will be established as at present exists among *astronomers and chemists*.

But to return to the object of this work

DEF. I.

Baron de HALLER calls that a SENSIBLE PART of the human body, which, upon being hurt transmits the impression to the soul; or which, in other words, occasions evident signs of pain and disquiet in the animal.

* Dr. BROWN appears by his writings to have been the first who formed a *system of Physic* on the *irritability* of the Fibre; this system, vulgarly called the BRUNONIAN SYSTEM, AS IMPROVED BY THE NEW DISCOVERIES IN CHEMISTRY, is the object of the present work.

† It is to the writings of these gentlemen that the Author of MEDICAL EXTRACTS owes his chief obligations. Other works, however, have been consulted, and in the illustration of this *new System*, it is attempted, as much as possible, to obtain the voice of every one,

DELECTANDO pariterque MONENDO.

HOR.

DEF.

DEF. II.

On the contrary, he calls that **INSENSIBLE**, which being burnt, tore, pricked, or cut till it is quite destroyed, occasions no sign of pain or convulsion, nor any sort of change in the situation of the body:

DEF. III.

And he calls that an **IRRITABLE PART**, which becomes shorter upon being touched; very irritable if it contracts upon a slight touch, and the contrary, if by a violent touch it contracts but little.

We have therefore a *threefold division* of the human body into **PARTS**,

1. **SENSIBLE;**
2. **INSENSIBLE;** and
3. **IRRITABLE.**

On the contrary, he calls that INSENSIBLE, which being burnt, tore, pinched, or cut till it is quite destroyed, occasions no sign of pain or confusion, nor any sort of change in the situation of the body.

FABLES relate that VENUS was wedded to VULCAN, the Goddeſs of beauty to the God of deformity. The tale, as ſome explain it, gives a double representation of art; VULCAN ſhewing us the *progreſſions* of art, and VENUS the *completion*. The *progreſſions*, ſuch as the hewing of ſtone, the grinding of colours, the fuſion of metals, theſe all of them are laborious, and many times diſguſtful: the *completions*, ſuch as the temple, the palace, the picture, the ſtatue, theſe all of them are beauties, and juſtly call for admiration. Now if *Anatomy* and *Phyſiology* be arts not ending in themſelves, but have a view to ſomething farther, they muſt neceſſarily be arts of the *progreſſive character*. If then, in treating on them, the ſubject ſhould appear *dry* rather than *elegant*, *ſevere* rather than *pleaſing*, let it plead, by way of defence, that, though its importance may be great, it partakes from its very nature, which cannot be changed, more of the *deformed God*, than of the *beautiful Goddeſs*.

HARRIS.

THE APOLOGY.

It is with some reluctance that I present to the humane Reader this useful detail of experiments on animals, though I think a better apology may be given for these, than for the *diversions* of hunting, fishing, and shooting, which are universally tolerated in civilized societies:—and, perhaps, the compassionate Reader, like those who do not object to the enjoyment of the fruits of these sports and pastimes, as they are improperly called, so may he peruse with some pleasure the conclusions drawn from the sufferings of nature, inflicted by man on animals, from the more *exalted motive* of *philanthropy*.

IRRITABILITY is one of those grand truths which is undeniably demonstrated; and *Posterity*, which alone stamps the merit of discoveries, by *abstracting of persons*, will promote *this discovery* to that rank, which its USEFULNESS intitles it to. She will laugh when she observes, that after its opposers had failed in persuading us there was *no such thing*, they should endeavour to render the doctrine *odious*, by the consequence which they pretend naturally follows from it. She will be diverted to see Physicians following the example of religious *Secularies* and *Devotees*, interesting the cause of GOD with *theirs*, and accusing of MATERIALISM, such as differ from them in opinion as to the pulsations of the Heart, and motion of the other organs. A certain author, well known for the greatness of his talents, and the bad use which he made of them, has endeavoured to draw *this induction*; but the illustrious De HALLER, who was seriously affected at the imputation, has ably refuted the futility of such impious and absurd reasoning.

TISSOT.

I. OF IRRITABLE PARTS.

It is observable, that the motion of the HEART* *The Heart.* not only survives that of the organs of voluntary motion, but continues a considerable time even after it is separated from the body. Nay, after it has even ceased to palpitate, yet as it still retains a latent power of contraction, its systole and diastole may, by the application of stimuli, be alternately renewed and continued some time longer. Hence in drowning or suffocation, though the pulse be imperceptible, and life apparently extinguished, yet the heart still preserves this latent power or susceptibility of motion; for though unable to propel the blood through the vascular system, yet it wants only to be gently excited by suitable stimuli to renew its action.

* Vide Numbers I. and II. of the Plates of the HEART; of the natural Size, to shew the Circulation and the Effect of Vital Air on the Blood. Printed for Johnson, St. Paul's Church-yard; and Robinsons, Paternoster-Row. Price 7s. 6d.

Plates also of all the internal viscera of the human body, of the natural size, will be printed in colours, to illustrate this work, if the public, anxious to know of what parts they are composed, give this undertaking (a specimen of which has been already exhibited) the encouragement which it seems to merit.

In the first rudiments of animal life, even before the brain is formed, the PUNCTUM SALIENS points out the embryo heart in miniature, and marks its *primæval irritability* as a sure presage of vitality.

The heart of the chick begins to move, before we dare presume, that there is any organ for distributing the nervous power. The PUNCTUM SALIENS, is the heart of the chick; it is seen beating while the body of the chick is but a rude, unformed, and gelatinous mass.

As this singular organ exhibits *irritability* the first, so it never relinquishes it till the last, and may therefore be considered as the PRIMUM MOBILE and ULTIMUM MORIENS of the animal machine.

In animals with cold blood * the *irritability* is very

* It is pleasing, says Dr. THORNTON, in his communication to Dr. BEDDOES, to observe, that in the animated world, where the *stimulus in the blood is great*, the IRRITABILITY of the contractile fibre is *less*; or in other words, that the IRRITABILITY of the contractile fibre is in exact unison with the quantity of *oxygenated blood*. Hence the reason of the *long life* of the heart of fishes, as it is called, and of all that class of animals, whose blood is but *little oxygenated or cold*, and why these seem so very *tenacious* of life. Vide the Supplement to Dr. BEDDOES's *Observations on the Nature and Cure of Consumption, Fever, &c.*

Does not this observation confirm the doctrine supported in this work, that the IRRITABLE PRINCIPLE is neither OXYGEN nor CALORIC, however it may be increased by *these principles*? Vide Vol. III. *On Oxygen as the Principle of Irritability.*

great,

great, and continues a long while. The heart of a *viper* will palpitate when taken from its body twenty-four hours, and that of a *turtle* thirty or longer; and in animals whose blood is hot, it moves until the fat is rendered stiff by the cold, at which time the motions of the heart and all the other muscles commonly cease.

The celebrated BOERHAAVE acknowledges an active force in the *heart*, and a latent principle of motion in the pieces of it when cut, but he nevertheless attributes this to the *nerves*, though the communication with the brain has been cut off! Dr. WHYTT follows the same path, but with this difference of expression, he uses the term *irritability*, and imputes it to the *soul*, which feeling the impression of the *irritation* occasions the contraction of the fibre, the *soul* therefore with him is *devisible*, and resides in *every living part* of the body! Accordingly we find also, in other books, "All motion is owing to the *soul*, which being sensible of stimuli contracts the fibres which are touched, and pulls them back, to prevent their being injured *."

However simple this theory may be; and like the doctrine of *Phlogiston* among the chemists, however

* This is the *Vis Medicatrix* of CULLEN and the old Physicians.

commodious for disembarassing us from several difficulties, yet as it is not in unison with the phenomena, that are observed, it must be rejected.

1. For, in the FIRST PLACE, the most irritable parts are those that are *least sensible*, and therefore not subject to the command of the soul, which ought to be quite the reverse, if the *soul* was the principle of irritability.

2. In the SECOND PLACE, *irritability* continues after death, and in parts quite separated from the body, and deprived of its communication with the brain*, for there is nothing more common than to see the heart of a frog beat, and the muscles remain irritable, after the head has been taken off, and the spinal marrow removed.

3. And THIRDLY, it is generally allowed, that the *nerves* are the organs and the *brain* the receptacle of all our sensations, the sources of all our ideas; but the *nerves* and the *brain*, as will be presently shewn,

* The heart is observed before the brain in the embryo chick, and is supposed therefore to act independent of brain. Some children have grown their full period in the womb, where there has been found after birth no brain. Might not IRRITABILITY during the foetal period serve all the purposes of this *vegetative life*? but as soon as the infant is brought into the world, where voluntary motion and sensation is required, a state advanced above the *vegetable*, the babe without a brain instantly perishes.

are not irritable, therefore IRRITABILITY HAS NOTHING IN COMMON WITH SENSATION*.

MUSCLES are composed of longitudinal fibres *The Muscles.* which shorten themselves, and are so disposed that this contraction always serves some wise purpose. They elegantly terminate in tendons, which are braced by sheathes, and though so numerous, each occupies its proper place and just direction.

Colour was believed to be essential to the constitution of a MUSCLE. But in fowls, in amphibious animals, in fishes, in worms and insects, through all the gradations of animals, of different species or different sizes, the colours of the muscular fibre change. In fishes, and in insects, it is generally white; even in the human body, it is not essentially red; the fibres of the iris, and the muscular coats of the arteries, the muscles of the stomach, of the intestines, and of the urinary bladder, are colourless. We cannot therefore de-

* The heart is divided into two AURICLES and two VENTRICLES. The AURICLES communicate with their corresponding VENTRICLES, and have VALVES to guard this passage. The VALVES on the right side are called *tricuspidæ*, on the left *mitrales*. THESE prevent the recurrence of the blood into the AURICLES. The AURICLES and VENTRICLES may be said to be hollow muscles, or rather may be compared to two hollow cavities on each side formed of one muscle, and the left cavities or muscle are more abundantly furnished with fibres, because a greater force is required to propel the blood through the body than the lungs.

fine

find a muscle by that property which it often wants; but we may, with the utmost propriety characterize it by its CONTRACTILE POWER, the only true evidence of its nature; for the contraction of the iris proves it to be a muscle by truer marks than its colour; and by the same rule the muscles of a fish, or of the meanest insect, are as perfect as those of man.

Such is the connection betwixt muscles and their *contractile force*, or PRINCIPLE of IRRITABILITY, that the moment it dies, all its astonishing power is gone: and the muscle which could lift a hundred pounds while *alive*, can bear the weight but of a few pounds when *dead*. Whereas, on the contrary, all those parts that are IRRITABLE, as the ligaments, tendons, &c. are capable of bearing the same weight when *dead* as when *alive*.

This IRRITABLE, or CONTRACTILE POWER, in muscles, is that property by which muscles recede from certain stimuli, without any feeling, without creating any consciousness of action, and so little dependant is it upon nerves, that it is found equally perfect in *animals** and *plants* which have no nerves, and remains in parts severed from the body to which

* The polypus, according to John HUNTER, is devoid of nerves.

they

they belong. This IRRITABILITY is so far independent of nerves, and so little connected with feeling, which is the province of the nerves, that upon stimulating any muscle by touching it with a caustic, or irritating it with a sharp point, or driving the electric spark through it, the muscle instantly contracts: although the nerve of that muscle be tied; although the nerve be cut so as to separate the muscle entirely from all connection with the system; although the muscle itself be separated from the body; although the creature upon which it be performed, may have lost all sense of feeling, and have been long to all appearance dead. Thus a MUSCLE cut from the limb, trembles and palpitates long after; the HEART, separated from the body, contracts when irritated; the BOWELS, when torn from the body, continue their peristaltic motion, so as to roll upon the table, ceasing to answer to stimuli only when they themselves become actually dead. Even in *vegetables*, as in the sensitive plant, this contractile power lives. It is by this IRRITABLE PRINCIPLE, that a cut MUSCLE contracts and leaves a gap; that a cut ARTERY shrinks and retires into the flesh. Even when the body is dead to all appearance, and the nervous power

gone,

gone, this contractile power remains; so that if a body be placed in certain attitudes, before it be cold, its MUSCLES will contract, and it will be stiffened in that posture till the organization yields, and begins to be dissolved. Hence comes the distinction betwixt the IRRITABILITY of the muscles and the SENSIBILITY of nerves; for the IRRITABILITY of muscles survives the animal,—as when it is active after death;—survives the life of the part, or the feeling of the whole system, as in palsy, where the vital motions continue entire and perfect;—and where the muscles, though not obedient to the will, are subject to irregular and violent action;—and it survives the connection with the rest of the system, as where animals very tenacious of life are cut into pieces: whereas SENSIBILITY, the property of the nerves, gives the various modifications of sense, as vision, hearing, and the rest; gives also the general sense of pleasure or pain; and thus the eye feels, and the skin feels; but their appointed stimuli produce *no motions* in these parts; they are *sensible* but not *irritable*. The HEART, the INTESTINES, and all the MUSCLES of voluntary motion, answer to stimuli with a quick and forcible contraction; and yet they hardly feel the stimuli

muli by which these contractions are produced, or at least they do not convey that feeling* to the brain. There is no consciousness of present stimulus in those parts which are called into action by the impulse of the nerves, and at the command of the will: so that MUSCULAR PARTS have *all the irritability* of the system, with but *little feeling*, and that little owing to the nerves which enter their substance; while NERVES have *all the sensibility* of the system, but *no motion*.

The nervous influence is a mere stimulus to the voluntary muscles, as blood is to the heart and arteries; food to the stomach; or bile to the intestines. It loses its influence over the system sooner, than the irritable principle in the fibre fails: for the irritable state of the muscle continues long after the voluntary motion, or power of excitement from the nerves, is gone: for when we die *slowly*, the irritable principle of the muscles is exhausted in the struggles of death. If, while in perfect health, we are killed by a *sudden blow*, the irritable power of the muscles survives the nervous system many hours or days, and the flesh

* The cause of this curious phenomenon we shall particularly explain, when we come to treat of GANGLIONS. Vide Vol. IV. *Introduction*.

trembles, and the absorbents continue to absorb *; and often, as after suffocation, or drowning, we can, by operating upon this poor remains of life, restore the circulation, re-animate the nervous system, and recover that life, which seemed to have entirely left the body †; and thus the nervous influence, which seemed to animate the system, and to be the prime mover and source of life, owes its restoration to that, which was conceived to be but a secondary power.

*The Dia-
phragm.*

There are *some muscles* which have a *stronger contracting force* than *others*, and retain it a longer time after the animal is dead. The chief of these is the DIAPHRAGM ‡, which I have always observed to
move

* Vide Vol. I. Sect. XI. p. 109.

† Vide Vol. IV. Sect. XLVII. p. 557. *On the Mode of recovering drowned Persons.*

‡ The study of ANATOMY, as it leads to the knowledge of NATURE, needs not, says the illustrious CHESLDEN, many tedious descriptions, nor minute dissections; what is most worth knowing is soonest learned, and least subject to difficulties, while dividing and describing the parts, more than the knowledge of their uses requires, perplexes the learner, and makes the science tedious, dry, and difficult.

Upon this principle all the anatomical descriptions interspersed in this work will be conducted.

The DIAPHRAGM, or midriff, is a large broad muscle, that divides the *thorax* from the *abdomen*. In its natural state it is *concave* or vaulted above
the

move a long while after the other, when the animal was dead, or at least, by irritating the *phrenic nerve* which goes to that muscle, it could be renewed. I have seen it, says Baron de HALLER, irritable and tremble an hour or more after death, when the motion of the intestines had entirely ceased, and many others have witnessed the same along with me.

The CÆSOPHAGUS *, when irritated, contracts
itself

The œsophagus, or gullet.

the *abdominal viscera*, and *convex* towards the *thoracic*. It is called, by HALLER, "*Nobilissimus post cor musculus*," and, like it, is in constant action. At the same time of inspiration, it is then a *plane*, and its motions are in general one fourth less than the heart. Besides being a muscle of inspiration; it assists in vomiting, and the expulsion of *fordes*; and it marks our passions by its irregular action, as sighing, yawning, coughing, laughing. It is affected by spasms, as in hiccup, lock-jaw, &c. It is both a muscle of voluntary and involuntary action, and the cause of its *involuntary action*, and its *general sympathy* with all the violent motions of the body, deserves a fuller attention of the philosophic anatomist than has been hitherto bestowed upon it. Some strong characters of special contrivance we cannot fail to observe here.

1st. The diaphragm separates posteriorly into *two slips*, betwixt which the AORTA DESCENDENS passes.

2d. A little above this, and to the left side, in the most fleshy part of the diaphragm, there is a *direct opening* for the passage of the CÆSOPHAGUS, or gullet.

3d. There is also on the right side of the diaphragm a large triangular hole for the passage of the VENA CAVA ASCENDENS.

* The CÆSOPHAGUS, or gullet, is composed both of *longitudi-*
* C 2 *nal,*

itself very sensibly, and I have plainly seen its peristaltic motion after death, so that a morsel thrust into the œsophagus will be pushed upwards and downwards by the peristaltic motion excited by that stimulus.

The Stomach.

The STOMACH* is considerably *irritable*, and when touched with a corrosive, becomes immediately furrowed. If you irritate it with a knife, either at the *pylorus*, or elsewhere, it presently contracts itself; and when wounded the *borders* of the wound *retract*. You may see the *motions* of the *stomach* through the tendinous part of the DIAPHRAGM after it has been

mal, and *circular fibres*, but chiefly *circular*, abundantly more so than in the intestines; because this has no foreign power to assist it, and because it is necessary the food should make a shorter stay here than there. Hence it is that horses drink against the law of gravity. The inner surface is a smooth membrane, abundantly supplied with *mucilages*, to sheath this organ, and render the passage of the aliment easy.

* THE STOMACH is situated on the *left side* below the short ribs. The right side of the stomach is covered by the thin edge of the left lobe of the *liver*; the left presses on the *spleen*. Its figure nearly resembles the pouch of a bag-pipe, its *upper side* being concave, and the *lower* convex, and its *left end* most capacious. The entrance into the *œsophagus* on the left side is called the *CARDIA*; on the right, where the chyme passes into the *duodenum*, is named *PYLORUS*, where there is a *CIRCULAR VALVE*, or *sphincter muscle*, which hinders a regurgitation of the aliment. The stomach has *circular* and *longitudinal fibres*, and its *inner membrane* is beset with a strong and viscid mucus.

laid

laid bare, as also shining through the PERITONÆUM while the abdomen is entire. We therefore cannot doubt an instant of this organ being *irritable*.

The INTESTINES *, both *large* and *small*, are *The Intestines* extremely *irritable*. When the intestine is only slightly

* The INTESTINAL CANAL is usually five times the length of the individual. It is curiously convoluted in the abdomen. This space anatomists have thought fit to divide into 6 *portions*.

1st. The DUODENUM, because it is commonly reckoned in adults to be 12 inches long.—At a small distance from where the stomach joins it, the *common gall duct* and the *pancreatic duct* open into it; from the one it receives the *bile*, and from the other the *pancreatic juice*.

2d. The JEJUNUM, from its being in general found *empty*, on account of the fluidity of the chyme, the stimulus of this, and the bile, and the prodigious number of lacteals.

3d. The ILEUM, because of its situation near the pelvis, where the bones projecting like the wings of a phaeton are called *Ilea*.

4th. The COLON, which takes an arched direction:

5th. The CÆCUM, or *blind gut*, a pouch, as it were, of the colon, about 3 inches long, and called *blind*, from its being out of the direction of the passage of the food. Its diameter is twice as large as that of the other intestines. It has an *appendix*, called VERMIFORM, whose use is not well ascertained, which floats loose in the abdomen, and in the mackerel there may be seen above 150 of them.

6th. The RECTUM, or *straight gut*, is the last, and at its termination is surrounded by *circular muscular fibres*, called the SPHINCTER ANI.

The

slightly cut, the wound equally *retracts* its edges; but if cut quite through, these *curl* themselves *back*, so as to embrace the parts above, or in other words, they turn inside out. When a part of the intestine only is irritated, it contracts so strongly there, that the cavity is quite closed, and the contents are pushed into the neighbouring parts, either upwards or downwards, which dilate, and soon afterwards, being irritated by these contents, they contract, and push

The *three* first are termed the SMALL GUTS, the *three* last the GREAT. In the *small guts*, as is observed Vol. II. page 216, there are numerous PLAITS to detain the food, and allow a wider surface for its absorption. These are larger, and far more numerous near the stomach, where the food is thinner, than they are towards the colon. At the entrance of the *ileum* into the *colon*, there are two *very large* VALVES, which prevent the regrefs of the *feces* into the *ileum*. The *cæcum* and *colon*, besides having stronger muscular coats than the small intestines, are furnished with three LIGAMEN TOUS BANDS, running lengthwise on their outside, dividing their surface into three portions nearly equal. Though these appear like ligaments externally, they are made up in their inner structure of true muscular fibres. The ligament-like bands, which in the *cæcum* and *colon* are collected into *three* portions, are spread *equally* over the surface of the *rectum*; a wise precaution of nature, that no part of it may be weaker than another, lest it should give way in the efforts of egestion. The plaits are considerably fewer in the great guts. They have *all* an INNER MEMBRANE, studded with an infinite number of arteries, or glands, which pour out a lubricating fluid. They have *muscular fibres* both *circular* and *longitudinal*.

along

along whatever is contained. Very often, after the motions of the intestines have ceased, they are renewed again, and increased by little and little, by some *obscure cause* which restores their IRRITABILITY. After they have been taken out of the body, I have observed, continues Baron de HALLER, *this motion* rather to *increase*. They may be irritated *externally* either with a knife, a needle, alcohol, or corrosives, but their *internal surface* is much more irritable.

The GALL-DUCT *, and the other excretory ducts, are *inirritable*; that is, stimuli produce no motion in them. *The Ductus Communis Coledochus.*

The ARTERIES have been always supposed to be *irritable*. This idea is countenanced, FIRST, by seeing that the silk-worm has no heart, but only a large artery, which performs the office of a heart. SECONDLY, by the blood after death being expelled, whence these derive their name †; and LASTLY, by the motion of the fluids continuing, as may be seen in a mi- *The Arteries.*

* OF COMMON DUCT of the liver and gall-bladder, which enters the duodenum opposite the pancreatic duct. Vide note *, page xxi.

† ARTERIES, from *atr*, air; and *trahere*, to draw. Vide Note *, Vol. I, page 109.

croscope,

croscope, even when the heart has been removed. Unless this was the case, the *pulse* of the arteries, which resembles the systole and diastole of the heart, will be very difficult to be accounted for.

The Lacteals The LACTEALS * contract and empty themselves like the *arteries*, upon being touched with *vitriolic acid*, and there is the *same argument* for their being *irritable* as for the *arteries*, viz. though they be ever so full of chyle at the time when the animal dies, they empty themselves, and contract in such a manner, that you cannot discover any fluid within them in the *dead* animal.

When making a puncture with a knife, in *The Bladder.* the BLADDER † of a dog just dead, it will contract itself and force out its contents through the opening made in the abdomen.

* Called so from their containing *chyle*, which has the appearance of milk. The LACTEALS are vessels of absorption of infinite smallness, situated in the intestines. They increase in size, and terminate in a gland, called, the RECEPTACULUM CHYLI, whence this fluid proceeds along the THORACIC DUCT, which terminates in the left *subclavian vein*. The VALVES of the vessels of absorption are innumerable.

† For the anatomical description of this organ vide page xxx.

II. OF INIRRITABLE PARTS.

The LUNGS * appear devoid of *irritability*.

The Lungs.

* The LUNGS is situated on the right and left side of the heart. It is divided into two *lobes*, and these are subdivided into *lobules*, three on the right side and two on the left. The TRACHEA, or wind-pipe, descends into the lungs, and forms innumerable CELLS, which have a communication with each other, and give to this viscus a honey-combed appearance. In the membranes of these cells are distributed the branches of the two PULMONARY ARTERIES, and four returning vessels, or PULMONARY VEINS. "Some have thought," says the great CHESELDEN, "that in these cells, the AIR enters the blood-vessels, and mixes with the blood; but this opinion, however *probable*, wants sufficient experiments to prove it; air being found in the blood, as it certainly is, is no proof of its entering this way, because it may enter with the chyle. I think, says he, the most probable argument for the air's entering into the blood by the lungs, or rather *some particular part* of the air, may be fetched from the known experiment of each man in a diving-bell wanting near a gallon of fresh air in a minute; for if pressure only was wanting, they often descend until the pressure of the air is three or four times what it is on the surface of the earth. Dr. MONRO observes, that the water tortoise has very large lungs, consisting of larger vesicles than in land animals, and conjectures that this probably is the reason, why they bear to be longer without breathing, as they are provided with a larger quantity of that JE NE SCAI QUOI from the air, which is so necessary to life." We shall throughout this work trace, as far as possible, the true relation we stand in with respect to the external air, as upon the discovery of the true nature of the air, the great mystery of the office of the lungs and chylification is unfolded, and other matters of the utmost importance in the practice of physic.

* D

The

*Liver, Kid-
ney, and
Spleen.*

The LIVER *, KIDNIES †, and SPLEEN ‡, have also *no irritability*; that is, they do not retract the edges of a wound made in them as do the muscles, or when irritated shew the least motion.

* The LIVER is the largest gland in the body, of a dusky red colour, immediately situated under the vaulted cavity of the *diaphragm*, or midriff, chiefly on the *right side*, and somewhat on the *left* above the *stomach*. Exteriorly, or anteriorly, it is convex, inwardly it is concave; very thick in its superior part, and thin in its inferior. The upper side adheres to the diaphragm, and it is fixed to this, and the sternum, or breast bone, by a broad ligament, called *SUSPENSORIUM*. It is also tied to the navel by a ligamentous band, called *TERES*, which is the umbilical vein of the foetal state degenerated into a ligament. Both these bands serve to suspend it, while lying on the back, from bearing too much on the subjacent *cava*, or otherwise it might press on this important returning vessel, stop the circulation, and put a period to life. Dogs and cats, and other animals, who are designed for leaping, have their liver divided into many distinct lobules; which prevent a too great concussion of this viscus. Ours is divided into *two LOBES*, of which the right is considerably the largest.

† The KIDNIES are two oval bodies, situated in the loins, contiguous to the two last short ribs; the *right* under the *liver*, and the *left* under the *spleen*.

‡ The SPLEEN is situated immediately under the *diaphragm*, above the left *kidney*, and between the *stomach* and *ribs*. In figure it resembles a depressed oval, near twice as long as broad, and almost twice as broad as thick. It has been taken from dogs, says *CHESELDEN*, without any marked inconvenience to them. Its office is the late discovery of the celebrated lecturer on physiology, Dr. HAUGHTON, a short account of which is given in Vol. II. page 213.

If

If you irritate a NERVE *, the muscle to which it is distributed is immediately *convulsed*; that is, it contracts its fibres, but in this experiment there will not be found the *smallest contraction* of the NERVE. *The Nerves.*

I applied a mathematical instrument, says Baron de HALLER, marked with very small divisions, lengthways, to a *long nerve* of a living dog, in such a manner as I was certain to perceive the *slightest contraction*, but upon irritating the nerve *no contraction* whatever could be perceived.

* NERVES are white, firm, solid cords, which arise from the *cerebrum*, *cerebellum*, and *spinal marrow*, and are spread over every sentient portion of the body by innumerable filaments. *Ten* pair of nerves issue from the brain itself, and *thirty* from the spinal marrow. Those that go to the organs of sense are considerably larger than the rest, and are in part divested of their outer covering or external tunic.

III. OF SENSIBLE PARTS.

To point out what parts were *sensible*, we have the following experiments.

The Cerebrum, Cerebellum, and Medulla Oblongata.

Upon touching the BRAIN* with a knife, or in whatever way Baron de HALLER did it, or upon applying any caustic body, the animal was seized with violent convulsions, and contorted his body on the one side or the other in the form of a bow, expressing by its screams violent anguish.

The Spinal Marrow.

Having thrust a probe, says Dr. J. JOHNSON, into the SPINAL MARROW†, all the muscles of the limbs were violently convulsed.—The mus-

* The BRAIN is divided into two portions; that situated in the upper part of the skull, is called CEREBRUM, and that in the hind part, under the former, CEREBELLUM. On the external surface of the brain we see several inequalities, or *windings*, like the circumvolutions of the intestines, and the CEREBRUM divides into *two hemispheres* while the CEREBELLUM sends out an *oblong projection*, which passes through the large hole of the occiput, called MEDULLA OBLONGATA.

† The MEDULLA SPINALIS, or spinal marrow, is a continuation of the *medulla oblongata*.

cles

cles of the back were so convulsed, that the animal was bent backwards as in opisthotonos of the lock-jaw. The intercostal muscles were all contracted, and their natural action, that of drawing all the ribs nearer each other and upwards, was rendered a matter of ocular demonstration. The diaphragm was also strongly contracted.

The NERVES *, which derive their source from the brain, are themselves extremely sensible. It is impossible to represent to one's self, without having seen it, the vast pain and disquietude which an animal is thrown into upon touching, irritating, or even tying a nerve.

The Nerves.

The SKIN †, as being abundantly supplied with nerves, is found to be extremely sensible, for in whatever manner you irritate it, the animal makes a noise, struggles, and gives all the indications of pain that it is capable of.

The Skin.

The

* The nerves have been before described page xxvii.

† The SKIN is divided by anatomists into two distinct coverings. The outer is called CUTICULA, or *scarf-skin*; the inner CUTIS VERA, or *true skin*. Between these is interposed a slimy *mucus*, called RETE MUCORUM;

*The Mem-
branes of the
Stomach,
Intestines,
Bladder, and
Ureters.*

The INTERNAL MEMBRANES of the STOMACH *, INTESTINES †, BLADDER ‡, and URETERS §, being of nearly the same nature with the skin ¶, does in consequence enjoy the same sensibility.

MUCORUM; which is yellowish, brown, or black, as is the complexion. "The colour of *this mucus* being the only difference between Europeans, Indians, and Africans, for the fibres of the true skin are white," says CHESelden, "in all men."

* This part has been described page xx.

† Vide page xxi.

‡ The BLADDER is situated in the lower part of the belly, immediately behind the union of the pudendal bones, and above the rectum, or straight gut. It is the reservoir of the urine or aqueous part of the blood (a more particular account of the urine will be given when we come to Diabetes) secreted by the kidneys and sent from thence by its ducts, or URETERS; its external passage is called URETHRA, the neck of which, or more properly speaking the bladder, is secured by a circular muscle called SPINCTER URINÆ, the fibres of which close this opening, except under the great irritation of distention, or from the commands of the will. The coats, or tunics, of the bladder are the same as those of the intestines, stomach, and œsophagus, viz. an *internal* membranous, sensible, and secreting mucus, a *middle* muscular, and an *external* also membranous, but insensible.

§ The URETERS are tubes, about the size of goose-quills, and about a foot long; they arise from the kidneys, and enter the bladder near its neck, running for the space of an inch *obliquely* between its coats, they form to themselves as it were valves, so that upon the contraction of the bladder, the urine is darted along the URETHRA, which is its proper passage.

¶ These several parts *differ* anatomically from the skin in this. They have no *cuticle*, nor *rete mucosum*, though they secrete a fluid analogous to this. They *differ* from the skin also in having *muscular fibres* immediately under them.

The MUSCULAR FLESH is sensible of pain, *The Muscles.* which is dependant entirely on the nerves. For if you tie the nerve going to any part, that part becomes immediately *paralytic* below the ligature and *insensible*. Its vital functions however remain. A blister applied to the part below the incised nerve inflames and draws up the outer skin, though it does not create pain; ulcers are healed, and suppurate, and the limb seems to have lost nothing but the power of motion.

The Mammæ, or BREASTS*, as being covered *The Breast.* with a good deal of skin, and furnished with many nerves, has also a proportionable degree of sensibility.

* Each BREAST is a CONGLOMERATE GLAND, or an assemblage of glands to separate milk, with their EXCRETORY DUCTS, which are capable of much distention, tending towards the nipple, and as they approach, unite, so as to make but a few ducts at their exit.

IV. OF INSENSIBLE PARTS.

IN order to discover what parts were *insensible*, Baron de HALLER made the following experiments.

*The Dura
Mater.*

The DURA MATER* is a kind of periosteum, every where applied to the internal surface of the cranium, connected to it by vessels, and has arteries transmitted through it to the skull, in the same manner as they are transmitted through the periosteum to the other bones of the body. It is composed, like all the other membranes of the body, of cellular substance, and like them is perfectly *insensible*, so that it may be burnt with vitriol, cut with a knife, or tore with a pair of pincers, without the animal, the

* The DURA MATER is a very compact strong membrane lining the inside of the skull, firmly adhering at its basis, and but lightly at the upper part, except at the sutures. It extends itself across the skull, so as to divide the *cerebrum* into two *hemispheres*. This part of the membrane is called the *FALX*, and prevents in great measure the concussion of this part. It again projects laterally, and sustains the posterior part of the *cerebrum*, which hinders it from compressing the *cerebellum*.

object

object of the experiment, appearing to suffer the least pain.

The brain naturally divides into two parts. The upper portion is called the *cerebrum*, and the smaller and lower portion the *cerebellum*. These are sheathed by a membranous covering called the PIA MATER*. Having removed, says Baron de HALLER, a portion of the skull, with the *dura mater* contiguous to it, I touched it with butter of antimony, whereupon it was burnt to a scar, without the animal complaining in the least, or making any sort of struggling, or being at all convulsed.

The Pia Mater.

The insensibility of the PERIOSTEUM† was long ago observed by Mr. CHESELDEN, nor are we at all surpris'd at this, seeing there are no nerves distributed to it. I have torn and burnt the *periosteum*, without the animal's shewing the least sign of pain; nay young kids have suck'd during the experiment: whereas when pinch'd they have shewn the most evident marks of pain.

The Periosteum.

* This is an exceeding fine MEMBRANE, which invests the brain even between its folds, hemispheres, &c.

† A smooth MEMBRANE covering the bones.

* E

That

The Peritonæum.

That the PERITONÆUM* is insensible I proved by repeated experiments, which I carefully made after I had dissected away the *recti muscles*, which cover this membrane.

The Pleura.

I next made my experiment on the PLEURA†, having freed it from the *intercostal muscles*, which we know are well supplied with *nerves* (the experiment was difficult, but I have frequently done it, and most

* Below the diaphragm, or midriff, under the muscles of the belly, lies that membranous expansion called the PERITONÆUM, which is a much stronger covering than the pleura, and confines the intestines and contents of the abdomen.

† Every distinct part of the body is covered, and every cavity is lined with a single MEMBRANE, whose thickness and strength is as the bulk of the part it belongs to, and as the friction to which it is naturally exposed. Those membranes, which contain distinct parts, keep the parts they contain together, and render their surfaces smooth, and less subject to be lacerated by the actions of the body; and those which line cavities, serve to render the cavities smooth and fit for the parts they contain to move against. The membranes of all the cavities that contain solid parts, are studded with glands, or are provided with vessels, which secrete a MUCUS to make the parts contained move glibly against one another, and not adhere together. The PLEURA lines the whole cavity of the chest, where the heart and lungs are placed, and gives it that smooth and glossy appearance, which when these organs are removed we cannot fail to observe. It meets as it were on the breast-bone on each side, and then becoming more compact, separates, and extending so as to form an acute triangle, it divides the two great lobes of the lungs, and is here called MEDIASTINUM. It then passes towards the vertebrae of the back, where it assumes again the name of pleura.

successfully

successfully on a kid, it being a very quiet animal), and even upon the PERICARDIUM *, in all which cases the membranes being cut or irritated, occasioned no sense of pain, nor the least change in the animal.

The Pericardium.

The celebrated STORCH, as appears by the journal of the disease of which he died, was not sensible of any pain, while in performing the paracentesis, the trocar pierced the PERITONÆUM. Upon this occasion I foresee that many eminent physicians, who place the seat of head-ach and phrenites in the MEMBRANES of the brain, and the violent pain of the pleurisy in the membrane of the PLEURA, will differ from me in opinion. But I only relate facts, and as a searcher after truth, it is immaterial to me on which side nature decides the question. Neither are these truths altogether repugnant to pathology. BOERHAAVE affirmed long ago, that in inspiration, the PLEURA of the ribs was less upon the stretch, because the ribs by means of the intercostal muscles ap-

* The PERICARDIUM, or heart-purse, is an exceeding strong membrane, which covers the heart, even to its basis. Its uses are to keep the heart from having any friction with the lungs; and to contain a fluid to lubricate its surface. It is firmly fastened to the great vessels that enter into, and issue from, the heart; as also to the diaphragm.

proached nearer each other, and on the contrary, in expiration, *this membrane* was more tense because the ribs receded to a greater distance from each other. But in *pleurisy* the patient suffers most in *Inspiration*; that is, when the PLEURA is *least distended*, and *vice versa*; wherefore that great man did not place the seat of this disease wholly in the PLEURA, but he joined it with an inflammation of the *intercostal muscles*, which serve to bring the ribs nearer together, and which we have before proved to be a sensible part.

I am much disposed, says the present celebrated professor of physic at Edinburgh, Dr. MONRO, to join with those who think that we mistake the true seat of the pain in *pleurisy*. I caused, says he, the operation for emphysema to be performed three times, and I was particularly attentive to this question. I scratched and tore the PLEURA, yet the patient did not make any remarkable complaint, and I would have concluded so, from this plain consideration, what is the use of the pleura? It is a mere soft lining to obviate the evil of friction, and I could not imagine that NATURE would have formed this acutely sensible. I crooked a probe, and turning the point against the

PLEURA, I pricked it rudely, and the patient just felt that I was pressing him, but experienced no pain. In one case I caused the side to be perforated, and introduced a bougie *ten inches*, and turning it round, the patient felt something moving, but no pain. I repeated this some days after the operation, when an inflammation was come on, and still with the same effect. I have repeated the experiments of HALLER on quadrupeds, cutting away the intercostal muscles, and have torn away the PLEURA without the animal seeming to complain.

If the dura and pia mater, and likewise the pericranium, and the peritonæum, and pleura, be found void of sensation, there is little expectation that other membranes should possess a different characteristic property; and indeed the MEDIASTINUM* and OMENTUM† are mere reflections of the

The Mediastinum and Omentum.

PLEURA.

* Vide note †, page xxxiv.

† The OMENTUM, or cawl, in Greek *επιπλουν*, is a broad, thin, and transparent membrane, arising from the inferior and interior border of the stomach, and reaching down as far as the navel; then doubling backwards and upwards, is connected with the colon. Besides its principle connections with the stomach and colon, it is likewise attached to the duodenum, to the spleen, pancreas, and MESENTERY, which is a membrane fastened to

the

*The Cellular
Membrane.*

PLEURA. All these membranes being destitute of nerves, are of the same nature as the **CELLULAR MEMBRANE***, and are therefore insensible to stimuli.

There the intestines, along which the lacteals run. The omentum lies immediately under the peritonæum. It is every where a double membrane; I speak not of its great fold already mentioned; but every portion of the thin membrane, by itself, may be divided into two thinner membranes, which are joined together by cellular texture, in the cells of which the **FAT** is deposited. The secretion here is performed in the most simple manner, like secretions in plants, there being no glandular apparatus. The fat is distributed very unequally in the *omentum*, as you may find it in some places very thin and transparent, and in other places above an inch thick. The omentum, or cawl, in calves, gives a very beautiful representation of this fact. The *uses* of the *omentum* are first to interpose between the peritonæum, the intestines, and the stomach, to keep all these parts moist, warm, slippery, and to hinder their adhesion; but most probably its chief use is to furnish **OIL** to the liver to be converted into **BILE**, which is composed of *alkali* (azot and hydrogen) and *oil* (hydrogen and oxygen). For the fat, though it is deposited in the cells of the omentum, yet must it have some kind of circulation; otherwise its store would be continually augmenting beyond measure; and as there are here no other excretory ducts but veins, and these all terminate in the **VENA PORTARUM**, which vessel goes to the liver, carrying to its secretory vessels that fluid, from whence in part **BILE** is generated; and hence it is a reservoir for the formation of the bile, as the spleen is for the formation of the pancreatic juice.

* The **CELLULAR TEXTURE** is continued without interruption all over the body, and is insinuated into every recess. It is composed, not of fibres laid together or interwoven, nor of small tubes, or vessels, though they run along it, being only adventitious, and no part of its true structure, but of unorganized **LAMELLÆ**, like fine scales. The lamellæ receding from one another, which partly again uniting transversely, forms cells, in such

There is no doubt of the CUTICLE*, or scarf-skin, being insensible, seeing you may cut it, as with corns, which is only an increased cuticle, or burn it with nitrous acid, until you give it a durable taint, without occasioning the least pain. *The Cuticle.*

such a manner as to communicate together all over from head to foot. If we conceive a sponge, in which every cell opens into all those that are contiguous to it, we shall form a just idea of the cellular texture. Its CELLS are in some places smaller, in others larger; it is dilatable by a very small force, where it is not confined by the resistance of neighbouring parts. Where its cells are largest, and its texture loosest, it contains fat, as immediately under the skin, almost over all the surface of the body, between it and the most external muscles; in the intervals, or interfices, between one muscle and another; in the omentum, around the kidneys, &c. This membrane, web, or texture, by laborious dissection, by blowing air into it, by injections, by maceration, hath been found to follow every visible bundle of muscular fibres, every tendon, every vessel, even every the minutest nerve. We shall find it constituting a great part of the oesophagus, stomach, intestines, urinary bladder, &c. So that there is no physical point in the whole animal fabric, in which there is not a portion of the cellular texture. Its use and importance in the animal body is very great. It serves as a bond of union, by tying and fastening all the parts together, yet in such a manner, as not to prevent or obstruct their necessary motions: to contain fat, if required; or marrow; or serum; or a thin vapour; to render parts smooth, and moist, and flexible; and to hinder them from growing together. It yields a commodious way or road for vessels and nerves to glide along. It furnishes a considerable part of the linings of the great cavities of the body, and immediately covers and envelops each particular viscus of the body; inasmuch that HALLER, who, of all anatomists, hath most minutely examined, and most fully and extensively considered it, declares, "that for certain the far greater part of the animal body is composed of it."

* Vide page xxix.

*The Rete
Mucosum.*

THIS GLUTEN* which divides the cuticle from the cutis vera, or true skin, as it cannot easily be separated from the cuticle, it becomes impossible to try experiments upon it; but one may reasonably suppose, like *other fluids*, it has no feeling.

The Fat.

The FAT† is a fluid contained within the cellular membrane. That this fluid may be pierced without inflicting pain, may be seen by a needle thrust into the flesh of a hog, who will shew no signs of pain, until it has got quite through the fat and reached the flesh below.

The Tendons.

The constant event of my experiments was, that the animal whose TENDON‡ was lacerated, burnt, or pricked, remained quiet, without shewing any signs of pain, and when part of the wounded tendon remained, it would walk without complaining. After I was fully satisfied of the event, I had no difficulty in discovering the cause, there being *no nerves*

* Vide page xxix.

† Vide Vol. I. page 27.

‡ TENDONS are not condensed muscular fibres, but condensed cellular membranes attached to muscular fibres, for the convenience and beauty of this elegant part of our machinery.

that

that I could trace to that part. Seeing therefore in the human body the nerves *only* are capable of sensation, it is neither unnatural nor improbable that the tendons being destitute of nerves should have no sensation. I have oftener than once seen the tendons laid bare in men, and, emboldened by the experiments which I have made on brutes, I once laid hold, with a pair of forceps, of the naked tendon of the flexor, that bends the third joint of the fore-finger, without the gentleman being in the least sensible of it. I have likewise seen the supinator longus chafed with hot oil of turpentine, in order to stop an hæmorrhage; it occasioned an acute pain in the skin, but the patient felt none in the tendon. Wherefore there is no need of fear from the accident of the ruptured tendon. I have seen a new cellular substance grow in a few days, and unite the TENDO ACHILLIS* that was cut through in a dog. As soon as the edges were united, the animal suffered no inconvenience, and jumped with the same agility upon the chairs as before.

When we cut open, says BELL of Edinburgh, a fascia or *tendinous membrane*, there is little pain: when, as in amputation, we cut the tendons even

* The tendon of the heel.

and neat, there is no pain: when we snip with our scissars the ragged TENDONS of a bruised finger to cut it off, the patient does not feel: and lastly, when we see TENDONS of suppurated fingers lying flat in their sheaths, we draw them out with our forceps, or touch them with probes, without exciting pain. Oil of vitriol has been poured upon each of the parts belonging to a joint, and a piece of caustic has been dropped into its cavity, but still no pain ensued; nay, some have been so bold, may I not say so vicious, as to repeat these experiments upon the human body, pinching, pricking, and burning the TENDONS of the leg, and piercing them with knives, in a poor man, whose condition did not exempt him from this hard treatment; who was ignorant of this injustice that was done him, while his cure was protracted, and he was made a cruel spectacle for a whole city!

In a cat I filled, says Baron de HALLER, the articulation of the femur with the pelvis with vitriolic acid, without its seeming to feel this violent corrosive. Sometimes instead of caustics I have tried the knife, and have transpierced the CAPSULE of the knee, and

The Capsule.

and the **LIGAMENTS**, and scraped the patella, *The Liga-
ments.*
without the animal shewing the least sign of pain.

And indeed it is well ordered by nature, that those parts which are exposed to continued friction should be void of sensation *.

The insensibility of **BONES** is still disputed, and *The Bones.*
indeed I have made no experiments upon this subject, for in that cruel torture which is required to lay bare the bones it is nearly impossible to distinguish the two pains. In the large bones I never could find any nerve entering the bone, and I have seen the operation of the trepan performed upon sound persons who had the free use of their senses, without their complaining of any increased pain during the perforation of the cranium †.

Several authors have affirmed the **MARROW** to *The Marrow*
be extremely sensible, but seeing no nerves enter the

* In a state of health these parts are certainly *insensible*. In the state of disease is the neighbouring and sentient parts *also* in a state of disease, or whence the pain from *white swellings*, &c. ? This subject deserves the most serious attention of the philosophic anatomist, and we shall again reconsider it when treating on diseases.

† In the case of *nodes*, &c. are not the bones sensible ?

bones, and that it is of the same nature as fat, it appears highly improbable.

The Teeth.

The sensibility of the TEETH* to heat and cold is wisely provided, that nothing might pass into the stomach that might irritate so important an organ. But otherwise they are insensible, being often scaled and filed without the person complaining in the least.

The Gums.

It is wisely ordained that the GUMS† should be insensible. Hence they serve, when the teeth are removed, the office of mastication, and are lanced or cut without the least sensation of pain.

We have seen then there is a difference in the parts of the human body, according to the several *uses*

* Vide Vol. II. page 240. The TEETH are of three kinds.

1. The *incisores*, or cutting-teeth, being made of the form of a chisel.
2. The *canini*, or dog-teeth, being pointed in the form of an awl.
3. The *molars*, or grinders, having a flat and uneven surface for grinding, shaped like an anvil.

† In the state of *inflammation* they seem to have some sense of feeling, and excite a dull sensation of pain. Vide Vol. VI. *On the Nature of Diseases and their Management.*

for

for which they are designed; some are vascular and soft, others bony and hard; some sensible, and very prone to inflammation and disease; others callous and insensible, have little action in their natural state, and little proneness to disease.

The greater part of the body is merely insensible and inirritable matter, united into a moving and perfect whole. In some places there is such a conflux of nerves, as form the most delicate and perfect sense, endowing that part with the fullest life; while others are left without nerves, almost inanimate and dead, left feeling, where it ought not to be, should derange the whole system.

The living parts of the system are the muscles and nerves; the *muscles* to move the body, and perform its offices, each muscle* answering to its particular stimuli, and most of them obeying the commands of the will; the *nerves* to feel, to suffer, and to enjoy, to issue the commands of the will, bringing the muscles into action: but still the muscles have their own *peculiar life*, or *irritability*, superior to the nerves, and independent of them. It is a power which survives that of the nerves, acting even when severed from

* Including the *hollow muscles*, as the heart, arteries, lymphatics, stomach, intestines, &c.

the general system; and acting often on the living body, without the impulse of the nerves, and sometimes in opposition to the will.

The insensible and inirritable matter of the system joins these living parts, and performs for them every subservient office,—forms coverings for the brain;—coats for the nerves;—sheaths for the muscles;—tendons,—ligaments,—and all the apparatus for the joints;—unites them into one whole by a continued tissue of cellular substance, which has no interruption, and suffers no change, but still preserves its own insensible nature, while it joins the sentient and moving parts to each other. The tendons, ligaments, periosteum, and capsules of joints, are all composed of this cellular substance, which by its *elasticity*, binds and connects the parts, and by its dead and insensible nature, is less exposed to disease, and appears therefore to be the fittest medium of connection for the *living system*.

DEFINITIONS.

STIMULI are the causes of actions in animals, and are of two kinds.

1. Direct, producing force, or strength in the animal.

FIRST.

2. Indirect, producing a want, or weakness in the animal, and a desire of the animal to remove it.

DIRECT STIMULI.

- 1. The retrocession of the fibre upon the application of stimulus, and is in proportion to the strength of the fibre.
- 2. The quantity of stimulus applied.
- 3. The degree of stimulus applied.

THE LAWS OF THE ANIMAL ECONOMY.

ARE THE CHANGES that the fibre and vessels undergo, upon the application of stimulus.

DEFINITIONS.

STIMULI, are the *exciters* of ACTIONS in animated bodies, and are of *two kinds*.

1. DIRECT, producing TONE, or STRENGTH, in the *fibre*;—and an EXPENDITURE of the *irritable principle* :
2. INDIRECT, producing ATONY, or WEAKNESS, in the *fibre*;—and an INCREASE of the *irritable principle*.

ACTION, or EXCITEMENT, in animated bodies, is the RETROCESSION of the *fibre* upon the application of *stimuli*; and is in *proportion*,

- 1st. To the STRENGTH of the *fibre*,
- 2d. The QUANTITY of *irritable principle*,
- And 3d. The DEGREE of *stimulus* applied.

THE LAWS OF THE ANIMAL ŒCONOMY, are THE CHANGES that the *fibre* and *irritable principle* undergo, upon the application of *stimuli*.

SECT. I.

ON STIMULI.

It has been lately shewn, how certain parts of the living body possess the property of *irritability*, or retrocession, upon the application of *certain stimuli*: a property which the *mimosa*, and other plants, seem also to partake, and which, being distinct from *sensibility*, does not depend on the same organs. It has been shewn also how *irritability* resides exclusively in the *muscular fibres*, whereas *sensibility* was proved to depend on the *nerves*. Thus if a nerve be divided, the *sensibility* of the part below the division will be lost, while its *irritability* still remains. Hence we find those parts which are destitute of *nerves* are not *sensible*, and those that are destitute of *muscular fibres* are not *irritable*.

When BARON DE HALLER published these discoveries in the year 1747, he formed the æra of a revolution in the science of medicine. He soon convinced the philosophic world, that there existed in the *living body* a particular

particular property, which distinguishes it from the *dead*, which may be regarded as the principle of all motion, a power diffused throughout every organ of the body, and without which, these could not perform their several functions. The disciples of this great man have therefore the justest reason to boast, that *physiology*, which before had been too long built on metaphysical and uncertain ideas, might now be considered as truly scientific, being erected on the firm basis of *actual experiments*.

After *astronomy* had shewn, that the immensity of space was filled with innumerable worlds, revolving round innumerable suns; those worlds themselves the centers of others, secondary to them, all attracting, all attracted, enlightened, or receiving light, and at distances unmeasurable, did the immortal NEWTON disclose to the astonished world THE LAWS WHICH THESE OBEYED.

In like manner, after *anatomy* had demonstrated a wonderful complicated structure of the human body, the parts so delicate, and their relations to, and influence upon, each other so immense, has another NEWTON, as it were, demonstrated, that all these several parts OBEY THE SAME GREAT AND FUNDAMENTAL LAWS.

This was the memorable discovery of the late Dr. BROWN, a *noted* author and teacher of physic, as he is styled by Dr. CULLEN, whom the prejudice of old age, and the pride of celebrity, conspired from receiving his doctrines, and who would fain persuade himself that the author, whom he *notes*, and against whom he protests, was really contemptible. For my part, says the illustrious Dr. BEDDOES, I consider Dr. BROWN's doctrine of *excitement* as a most perfect specimen of extensive reasoning, truly calculated to afford the fullest satisfaction to a just thinker. He avoids those unmeaning and vague terms, that had before been so much used to shelter ignorance from their employers and from others; he appeals to the phænomena of the living system obvious to the senses; and adopts such principles of reasoning, that if he has not always discovered the truth, he is never forsaken by the spirit of a true philosopher. Dr. DARWIN, who is no less eminent as a physician than a poet*, entertains similar sentiments with respect to the *Brunonian doctrine*, and allows his work to be, with a few exceptions, a performance of *great genius*. I do not mean here, however, to defend Dr. BROWN's personal conduct, which perhaps more than any thing else caused his doctrines to

* The celebrated author of *The Botanic Garden, or Loves of the Plants*.

be condemned unheard, as if the grossness of a man's manners affected the conclusiveness of his arguments. If his imprudence, however, was highly blameable, and his arrogance intolerable, the liberal will allow something to the deep consciousness of neglected merit, and to the irritating sensations attendant upon declining health: and posterity will perhaps reproach an age, in which a man, possessed of powers, *so superior*, and *so nobly exerted*, was brow-beaten, defamed, even driven from his country by shameless persecution *, and left to perish in LONDON in extreme penury. But to return to the main object of this part, *the laws of organic life*.

* Thank heaven! such *arts* cannot now prevail. Knowledge and improvement gain ground every day. Men of science, not bred to the profession, have begun to exercise *their own judgment*; and when that comes generally to be the case, *true merit* must be encouraged; many *abstruse* doctrines of old physicians will be exploded; and the tyranny of *empty pomp* and *learned mystery* in physic will be driven out of the land, and forced to seek shelter among less cultivated societies of men. *Philosophic instructions* on the important subject of health, delivered in a familiar way, cannot injure in the least *medical men*, who have the high advantage of EXPERIENCE together with EDUCATION; for no sober man of common sense will trust the *salvation of his soul* to a COBLER, nor employ a TAYLOR to defend *his property* in Westminster Hall. I am, therefore, fully persuaded, says Dr. ADAIR, that when the *thinking part* of the nation are taught what has hitherto been called the *mystery* of the profession, men in general will feel it their duty to support the REGULAR FACULTY, and will be weaned from being *quacked* by MISCREANTS, who are *as little qualified to practise physic*, as a COBLER is to preach, or a TAYLOR to plead a cause, or a MENDER OF KETTLES to repair (an instrument of far less complicated structure than the human body) your watch.

SECT.

SECT. II.

LAW I.

I. A DUE EXCITEMENT IS NECESSARY FOR THE
MAINTAINANCE OF HEALTH AND VIGOUR.

To obtain some conception of the grandeur of this subject, only imagine to yourself, by the ALMIGHTY FIAT, a stop put to the *movement* of all things. There would no longer be the succession of night and day, the changes of the seasons, the growing of the different productions of the earth, nor wind, nor rain, nor circulation, nor secretion, nor life. On the contrary, NATURE is ever performing her eternal rounds, and obedient to the *great command*, we pass onwards from a speck-like beginning to manhood, and from manhood to old

* *The laws of organic life*, when fully explained, are so obvious to every thinking mind, that it seems surprising they were not earlier elucidated, and brought forward to solve a number of difficulties respecting diseases, and their proper method of treatment. On account of their great simplicity, and their easy application in medicine, I durst not, says the learned Dr. BEDDOES, at first believe them to be true. They apply equally to the muscular and sentient fibres, which therefore throw much additional light and confirmation on each other.

age.

age. While we are thus running our course of life, every thing within us is in a *constant movement*. If we have existed even but a few years, the blood has been circulating from the heart through the lungs, and the body, *countless times*; and the stomach and intestines have been performing *innumerable* wave-like motions.

We have before shewn * that the *motion* of the heart and arteries, the stomach and intestines, depended on the *retrocession* of *irritable fibres* from *certain stimuli*, in the following sections we shall consider the EFFECTS OF DIFFERENT STIMULI † on the human body.

OF TEMPERAMENT,

EVERY age, every habit, if the excitement by *stimuli* be properly directed, has its due degree of vigour arising from it. *Childhood*, as possessing *abundant excitability*, admits of *moderate stimuli*; with an under proportion, it becomes *languid*; with excess, it speedily feels *oppressed*. In the middle period of life, where the *excitability* is in

* Vide Section XI.

† As heat, light, air, food, exercise, &c.

due power, a moderate stimulus is requisite to stir up all the actions of life. Old age, on the contrary, owing to a deficiency of excitability, requires a great deal of stimulus; it becomes enfeebled by too little, and quickly over-set by more.*

In one word, EXCITEMENT, the effect of *stimulating powers*, when of a *proper degree* and *suited to the person*, constitutes *firm health*; when either *excessive* or *deficient*, proves the occasion of *weakness* and *disease*.

* This verifies the old adage, "MILK is the food of *infancy*, and WINE of *old age*." What calumnies have not been thrown out against JOHN BROWN for this doctrine. If *low living* and *starving* are reprobated for the facts and reasons that presently will be assigned, why, therefore, should he be called a friend to *intemperance*? On the contrary, he only approves and tries to adjust the *proper standard*, condemning all *extremes*, and advising the *mean* under which VIRTUE takes her post. If he has any ways erred in this *difficult* but *honourable attempt*, as he certainly did not err *wilfully*, I know not why he should be held up as *criminal*, or *condemned* with *greater asperity* than the exploded theories of BOERHAAVE or CULLEN. This knowledge will assuredly, as Dr. BEDDOES justly observes, become a part, and the most important part, of education. Physiological ignorance is the most abundant source of *our sufferings*; every person *accustomed* to the *sick*, must have heard them deplore their ignorance of the *necessary consequences* of *those practices*, by which their *health* has been *destroyed*; and when men shall be deeply convinced, that the *eternal laws of nature* have connected *pain* and *decrepitude* with *one mode of life*, and *health* and *wigour* with *another*, they will avoid the *former*, and adhere to the *latter*. And as actions are often named immoral from their effects, self love, or the enjoyment of health, are *so far* the same. Nor is this sort of morality likely to terminate in itself; but the habit of acting with thought and resolution, will *extend* from the selfish to the social actions, and regulate the whole tenour of life.

U

SECT.

SECT III.

OF EXTREME HEAT.

HEAT, which is necessary, when *moderate*, to the production, growth, and the vigour * of animals and vegetables, may, like *other stimuli*, have also a *debilitating power*; as must be obvious to every one who pays the least attention to the operations in nature. During the *scorching heats* of summer, especially at mid-day, all nature languishes, and her energy is lost. The plants,

* Some years ago I cut out, says Dr. GARDINOR, the heart and part of the large vessels of a turtle, with a view to examine the structure of these parts, and the circulation of the blood in that animal. Having wiped off the blood and other moisture, the heart was wrapped up in a handkerchief; but engagements in the way of my profession obliged me to postpone my curiosity till about six or seven hours after it was cut out. When I examined it, there appeared not the *least* signs of life. It was much shrivelled and dried. But, by putting it into water, nearly *milk warm*, it plumped up, and some of its parts acquired a tremulous motion. Laying it on the table, and pricking it with a large needle, it palpitated several times. The palpitations were renewed, as often as the needle was pushed into its substance, until it became *cold*, when it seemed to be insensible to every stimulus. But, after *warming* it again in the water, it recovered its *irritability*, and repeated its palpitations on the application of the needle. Though no movement could be excited in it by any stimulus when *cold*, yet it moved several times after being macerated in *warm water*. This evidently shews the necessity of HEAT for maintaining the full powers of the contractile living principle. Vide Sect. IX. Part II.

exhausted of their vigour, hang their heads; their foliage droops: and among these the MIMOSA *, the DIONÆA MUSCIPULA †, with the HEDYSARUM GYRANS ‡, lose their sensibility and motion; whilst the various tribes of animals, panting for breath, seek some cool retreat. Even in our northern latitude this cannot escape our notice; but to see it in perfection we must visit the more sultry regions of the south, where the *African*, patient of heat, is obliged to intermit his labour, whilst the inhabitants of more temperate climates, such as *Italy* and *Spain*, retire into some dark recess and sleep.

The learned professor BOERHAAVE gives us some experiments, made by the celebrated FAHRENHEIT, with

* *Sensitive plant.*

† In the DIONÆA MUSCIPULA, or *fly-trap*, there is a most wonderful contrivance to prevent the depredations of insects: the leaves are armed with *long teeth*, and lie spread upon the ground around the stem. These are so *irritable*, that when an insect creeps upon them, they fold up, and crush, or pierce, the poor animal to death.

‡ The leaves of the HEDYSARUM GYRANS, or *whirling honey-suckle*, are continually in spontaneous motion; some rising and others falling; and others whirling circularly, by twisting their stems; this spontaneous movement of the leaves goes on when the air is perfectly still. A particular account, with a good print of the HEDYSARUM GYRANS, is given by Mons. BROUSSONET, in a paper on Vegetable Motions, in the *Histoire de l'Academie des Sciences*, Ann. 1734, p. 609.

view to discover the extent of heat living animals are able to endure.

A *sparrow*, subjected to air heated to 146 degrees of *Fahrenheit's* thermometer, after some struggles, died in less than seven *minutes*. A *cat* resisted this great heat somewhat above a *quarter of an hour*; and a *dog* in about 28 *minutes* died, after discharging a considerable quantity of a ruddy-coloured foam, which had such offensive qualities as to throw one of the assistants into a fainting fit*.

Messieurs DU-HAMEL and TILLET, having been sent into the province of Angoumois, in the years 1760 and 1761, with a view of endeavouring to destroy an insect which consumed the grain of that province, effected the same by exposing the damaged corn in an oven, where the heat was sufficient to kill the insects without injuring the grain. This process was performed at *Rochefoucault*, in a large *public oven*; where, for economical views, their first step was to assure themselves of the heat remaining in it on the day after bread had been baked. This they did, by conveying in

* Vide the story of the hole at CALCUTTA, where a *pungent steam*, like hartshorn, is said to have issued from those who were at a distance from the window.

a thermometer on the end of a shovel, which, on being withdrawn, indicated a degree of heat considerably above that of *boiling water*. But Monf. TILLET, conceiving that the thermometer had fallen many degrees at the entrance of the oven, and appearing under some embarrassment on that score, a girl, one of the constant attendants on the oven, begged that she might enter it, and mark with a pencil the height at which the thermometer stood within the oven. The girl smiled at M. TILLET's fears, and without hesitation entered the oven, and with a pencil, given her for the purpose, marked the thermometer, after staying *two or three minutes* at 100 degrees of Reaumur's scale, or, to make use of a scale better known in this country, at near 260 degrees of Fahrenheit's. M. TILLET began to be anxious for this girl, and to entreat her speedy return, but the girl crying out, "She felt no great inconvenience," remained in her present situation *ten minutes longer*; that is, near about the time when BOERHAAVE's cat parted with her *nine lives* under a much less degree of heat. She then came out, her respiration quiet, with a hurried pulse, and a complexion considerably heightened.

After

After M. TILLET's return to *Paris*, these experiments were repeated by Monf. MURANTIN, at *Roche-foucault*, an intelligent and accurate observer, on a second girl belonging to the oven, who remained in it, without much inconvenience, under the same degree of heat, as long as the other girl; and afterwards even breathed an air heated to about 325 degrees for the space of *five minutes*.

These experiments soon excited other philosophers to make similar trials, of which, the first on record in England, are those of Dr. DOBSON, at *Liverpool*, who gives the following account of them in the Philosophical Transactions.

I. TRIAL.

THE sweating-room of our public hospital at *Liverpool*, says he, which is nearly a cube of nine feet, was heated till the quicksilver stood at 202 degrees of Fahrenheit's scale. The thermometer was suspended by a string fixed to the wooden frame of the sky-light, and hung down about the centre of the room. A piece of wax, in this hot situation, began to melt in about
seven

seven minutes: another piece suspended by a string, and a third piece put into a tin vessel and suspended, began likewise to liquify in about the same period of time.

My friend Mr. PARK, an ingenious surgeon of this place, went into this stove, thus heated, with myself. After *ten minutes*, I found his pulse quickened to 120 pulsations in a minute. To determine the increase of the animal heat, another thermometer was handed to him, in which the quicksilver already stood at 98 degrees; but it rose only to 99 degrees and an half, whether the bulb of the thermometer was inclosed in the palms of the hands, or received in the mouth. The natural state of this gentleman's pulse is about 65.

2. TRIAL.

ONE of the porters to the hospital, a healthy young man, and the pulse 75, was enclosed in the stove, when the quicksilver stood at 210 degrees, and he remained there, with little inconvenience, for 20 *minutes*. The pulse now was 164, and the animal heat, determined by another thermometer, as in the former experiment, was $101\frac{1}{2}$.

3. TRIAL.

3. TRIAL.

A young gentleman of a delicate and irritable habit, whose natural pulse is 80, remained in the stove ten minutes, when heated to 224 degrees. His pulse rose to 145, and the animal heat to 102. This gentleman, who had been frequently in the stove during the course of the day, found himself *feeble*, and disposed to break out in *swelts* for 24 hours after the experiment.

Even these experiments, though more accurate than the former, do not shew the *utmost degree* of heat which the human body is capable of enduring.

Some other experiments, yet more remarkable, (as in them the body was exposed to the heat without clothes) are also related by Drs. FORDYCE and BLAGDEN, in the Philosophical Transactions. They were made in rooms heated by flues in the floor. There was no chimney in them, nor any vent for the air, excepting through crevices at the door. Of these experiments, the two following may be taken as a specimen.

I. TRIAL.

ABOUT three hours after breakfast Dr. FORDYCE, having taken off all his clothes except his shirt, and being
furnished

furnished with wooden shoes tied on with lilt, went into one of the rooms, where he staid *five minutes* in a heat of 90 degrees, and began to *sweat gently*. He then entered another room, and stood in a part of it heated to 110 degrees. In about half a minute *his shirt became so wet that he was obliged to throw it aside*, and then *the water poured in streams over his whole body*. Having remained in this heat for *ten minutes*, he removed to a part of the room heated 120 degrees; and after staying there *twenty minutes*, found that the thermometer, placed under his tongue, and held in his hand, stood at 100 degrees. His pulse had gradually risen to 145 pulsations in a minute. The *external circulation* was evidently increased, the veins had become very large, and an *universal redness* had diffused itself all over the body, attended with an uncomfortable sense of heat. He concluded this experiment by plunging into water heated to 100 degrees; and after being wiped thoroughly dry, was carried home in a chair; *but the increased circulation did not subside for two hours* *.

* Vide Sect. X. page 103.

2. TRIAL.

DR. BLAGDEN took off his coat, waistcoat, and shirt, and went into the room, when some water in a metallic vessel was observed to *boil* quickly, and the thermometer indicated a degree of heat above that of boiling water *. The *first impression* of this hot air upon the body was exceedingly *disagreeable*; but in a few minutes all his *uneasiness* was removed by the *breaking out of a profuse sweat* †. At the end of *twelve minutes* he left the room very much fatigued, his hand shook, and he was otherwise somewhat disordered. His pulse beat 136 in a minute, and the thermometer had risen to 220 degrees.

There seems, from these experiments, no longer any doubt, but that *heat is debilitating*, and deprives the body of all vigour and strength, and that the *evil effects* of

* When *cold water* is placed on the fire, it receives fresh accessions of heat, until the thermometer rises to 212 degrees: this is called the **BOILING POINT**, for the thermometer invariably stops at that point, never ascending the least higher. The *evaporation*, or *steam*, that then evidently takes place (which is proportioned to the accession of heat from the fire) solves to us the present difficulty: for if the steam be condensed, it will be found to give out *that quantity of heat* assumed from the fire, which we were just now puzzled to account for.

† Vide Sect. X. page 103.

superabundant heat is carried off, in a great measure, by *sensible perspiration*. We have, also, every reason to believe, that the faintness of *the body* is communicated also to the *mind*. Under such circumstances, were you to propose a bold enterprise, you would find, I believe, no daring, no spirit. His present weakness would render him averse to all exertions of both *body* and *mind*. His only virtue would be passive courage, and he would be afraid at that time of every exertion, being in a state of total incapacity.

The effects of HEAT, in producing a *noxious quality* in the air, are well known.

In the BRASILS, such are the *putrescent qualities* of the air, that *white sugar* will sometimes be full of maggots.

In *these tropical climates* they are obliged to expose their *sweetmeats* by *day* to the sun, otherwise the *night air* would quickly cause them to putrefy *. Here life is greatly abridged.

At

* On the contrary, in the cold arctic regions, animal substances, during the winter, are never known to *putrefy*; and meat may be kept for months,

At SENEGAL, I am told, the natives consider forty as a *very advanced* time of life, and generally die of *old age* at fifty.

At CARTHAGENA, in America, where the heat of the hottest day ever known in Europe is continual,—where, during their *winter season*, these dreadful heats are united with a continual succession of thunder, rain, and tempest, arising from their intenseness,—the *wan* and *livid complexions* of the inhabitants might make strangers suspect that they were *just recovered* from *some dreadful distemper*:—the *actions* of the natives are conformable to *their colour*; in all their motions there is somewhat relaxed and languid;—the heat of the climate even affects their *speech*, which is soft and slow, and their words are generally broken.

Travellers from EUROPE retain their *strength* and *ruddy colour* in *that climate*, possibly for *three or four months*;—but *afterwards* suffer such decay in *both*, that

without any salt whatsoever. This experiment happily succeeded with eight Englishmen that were accidentally left upon the inhospitable coast of *Greenland*, at a place where seven Dutchmen had perished but a few years before; for killing some rein-deer for their subsistence, and having no salt to preserve the flesh, to their great surprise, they soon found it did not want any, as it remained sweet during their eight months continuance upon that shore. GOLD-SMITH.

they

they are no longer to be distinguished from the inhabitants by their manners or complexion.

Few nations have experienced the mortality of these coasts, so much as our own:—in our unsuccessful attack upon CARTHAGENA, more than *three parts* of our army were *destroyed* by the *climate alone*; and *those* that *returned* from that *fatal expedition*, dragged on, ever after, a *languid* and *spiritless existence*.

In our more fortunate expedition, which gave us the HAVANNAH, we had little reason to boast our success;—instead of a *third*, not a *fifth part* of the army were left survivors of their victory, the climate being an enemy that even HEROES cannot conquer*.

* GOLDSMITH.

SECT.

SECT. IV.

OF MODERATE HEAT,

AND

EXTREME COLD.

WHEN the air is of that particular temperature, which is just sufficient for carrying off such a quantity of the heat generated in the body, that the remainder shall exactly suit the different functions of life, we say such an air is *mild*, or it is *temperate*; because we are not sensible of any troublesome degree of *heat* or of *cold*. This precise temperature varies in different people, according to the climate, age, and constitution, of the individual; but at whatever point of the thermometer this temperature may be, if it falls a few degrees only from that we have been accustomed to, we then complain of *cold*, and employ various ways of obviating its disagreeable effects.

Cold (that is to say, the *absence* of a *certain degree of heat*) strengthens the body, giving vigour to it, and energy to the powers of the mind. Its first effect is to abate perspiration. This is done by constricting the capillary

capillary vessels: hence the blood is propelled in an increased volume towards the heart. In consequence of which, the *reaction* of the heart and arteries sends back the blood with an increased velocity and power to the surface of the body, so as in a healthy subject to diffuse a genial warmth, and create a keen appetite for food, with a sense of lightness, alacrity, and strength.

The effects of temperature is, in a most satisfactory manner, illustrated by the learned and ingenious Dr. ROBERTSON, in his History of *America*, when taking a view of the effects of climate on the human body, he says, " In every part of the earth where man exists, " the power of climate operates with *decisive influence* " upon his condition and character. In those countries " which approach near to the *extremes* of heat or cold, " this influence is so conspicuous as to strike every eye. " Whether we consider man merely as an animal, or " as a being endowed with rational powers, which fit " him for activity and speculation, we shall find that " he has uniformly attained the greatest perfection, of " which his nature is capable, in the *temperate regions* of " the globe. There his constitution is most vigorous, " his organs most acute, and his form most beautiful. " There, too, he possesses a superior extent of capa-
city,

“ city, greater fertility of imagination, more enter-
 “ prising courage, and a sensibility of heart, which
 “ gives birth to passions not only *ardent*, but *persevering*.
 “ In this favourite situation he has displayed the utmost
 “ effects of his genius, in literature, in policy, in com-
 “ merce, war, and in all the arts which improve and
 “ embellish life.”

He accordingly divides the natives of AMERICA into
two distinct classes; the *one* inhabits the *temperate*, the
other the *torrid zones*, on both side of *the line*. He
 says, “ that the human species in the *former* appears
 “ manifestly more perfect: that the natives are more
 “ robust, more intelligent, more active, and more
 “ courageous. They possess, in the most eminent de-
 “ gree, that force of mind, and love of independence,
 “ which are regarded as the chief virtues of man in his
 “ savage state. These natives accordingly, though sur-
 “ rounded for several centuries past by polished and
 “ hostile nations, have hitherto maintained, in a great
 “ degree, their freedom and independence: but the
 “ *other* class, from the debility of their mind and body,
 “ their inactivity, want of active courage, and of that
 “ independence which characterises those living in the
 “ more *temperate climates*, have become so dependent as
 “ to

“ to be nearly in a state of slavery to those nations, who,
 “ for the sake of mines or commerce, have taken pos-
 “ session of their territories.”

If we look around the world, we shall be able to find not more than *six distinct varieties* in the human species, each of which is strongly marked, and speaks the kind seldom to have mixed with any other. The race we are at present about to consider are the men found near *the Pole*. These nations being under a rigorous climate, where the productions of nature are but few, and the provisions coarse and unwholesome, their bodies have shrunk to the nature of their food. These, therefore, in general, are described as a race of short stature*, and odd shape, with countenances as savage as their manners are barbarous. GUSTAVUS ADOLPHUS once attempted to form a regiment of such men, but he found it impossible to accomplish his design; for it should seem, says Dr. GOLDSMITH, as though they were unfitted for any other climate, or mode of life, but their own.

In these inhospitable regions all is *torpid*. Here you see, in the greatest possible perfection, the *sedative power*

* They are usually about four feet high, and the *tallest* does not exceed five feet. GOLDSMITH.

of extreme and continued cold. Here no vegetable thrives except the *lichen* ; and no animal but the *rein-deer* *. Nor is the extremity of cold less productive of the tawny complexion than that of heat. The natives of the *arctic circle* are all *brown* ; and those that lie most to the north are of a *still darker hue* †. In this manner *both extremes* are *unfavourable* to the human form and colour, and nearly the same debilitating effects are produced under *Poles* that are observed at the *Line*.

* Mr. Townsend.

† Cook's Voyage.

SECT. V.

ON LIGHT.

LIGHT, like air and water, is now known to be not a simple, but a *compound* body. The all-penetrating genius of Sir ISAAC NEWTON * has demonstrated, by undeniable experiments, that *a single ray of light*, which former philosophers imagined so infinitely fine, is in reality a collection of *seven parts*, which are perfectly distinct, and composed of as many different colours, and subject to different reflections and refractions.

Some

* It appears to me, says Lord *Bolingbroke*, that THE AUTHOR OF NATURE has thought fit to mingle, from time to time, among the societies of men, a few, and but a few of those, on whom he is graciously pleased to bestow a larger proportion of *the ethereal spirit* than is given in the ordinary course of his providence to the sons of men. Look about you from the palace to the cottage; you will find that the bulk of mankind is made to breathe the air of this atmosphere, to roam about this globe, and to consume, like the courtiers of *ALCINOUS*, the fruits of the earth. *Nos numerus sumus & fruges consumere nati*. When they have trod this insipid round a certain number of years, and begot others to do the same after them, they have lived: and if they have performed, in some tolerable degree, the ordinary moral duties of life, they have done all they were born to do. Look about you again, nay look, perhaps, into your own breast, and you will find that there are *superior spirits*, men who shew, even from their early youth, though it be not always perceived

Some modern philosophers have considered *heat* and *light* as one and the same substance. Although, it must be confessed, they are frequently found existing together, yet, on the other hand, must it be allowed, that there is often *much dazzling splendour* where there is *little or no heat*. The Honourable Mr. BOYLE draws a minute comparison between the light of combustible bodies, and that of shining wood, &c. Among other things he observes, that extreme cold *extinguished* the light of shining wood, as appeared when a piece of it was put into a glass tube, and held in a freezing mixture. He also found that rotten wood did not *waste* itself by shining, and upon the application of a thermometer he could not discover the smallest degree of *heat*.

That these are distinct substances, may be also proved from their distinct operations on the *living fibre*.

The muscular fibres of the retina are excited into instantaneous action by the smallest variation in *light*: but

by others, perhaps not always felt by themselves, that they were called into this world for something more and better. These are they, who engross almost the whole reason of the species, who are born to *instruct*, who are designed to be the *tutors* and *guardians* of human kind. When they prove such, they exhibit to us examples worthy of the highest praise, and they deserve to have their names recorded, instead of a crowd of warriors, with whose feats the page of history is crowned and disgraced.

are

are insensible to the greatest changes in the circumambient *heat*. Most of the discous flowers, obedient to the impulse of *light*, follow the sun in his course. They attend him in his evening retreat, and meet his rising lustre in the morning. If a plant be shut up in a dark room, and a small hole be made in the shutter, through which the *light* may penetrate, you would see the different plants confined there, turn towards that hole, and even alter their shape to creep through it, so that though these were *straight* before, they would in a short time become *crooked*, to obtain the full enjoyment of *light*. Thus if a GERANIUM be placed in any window for a certain time, the interior surface of every leaf would be turned to meet the *light*; and if you remove it to an opposite window, you would soon see a sad contortion and confusion among the leaves, until they had obtained a right position with regard to *light*. To prove that it is not *heat*, but *light*, which plants covet, if this GERANIUM be placed near a fire, which gives a stronger heat than the sun, you would soon observe it turn away its leaves and flowers from the *fire* to the *sun*.

To illustrate this curious circumstance, Dr. HILL placed a plant of *abrus* in a room, where it had moderate day-light, without the sun shining upon it. The lobes

of the leaves were then fallen perpendicularly from the middle rib, and closed together by their under sides. Thus they continued all night. *Half an hour after day-break*, they began to separate, and *a quarter of an hour after sun-rise*, were perfectly expanded. *Long before sun-set* they began to droop again, and towards evening were closed as at first.

Next day the plant was placed where there was *less* light. The lobes were raised in the morning, but *not so much*: and they drooped *earlier* at evening.

The third day it was set in a south window, open to the *full sun*.—*Early* in the morning the leaves had attained their horizontal situation: by *nine o'clock* they were raised above it, and continued so till *late* in the evening; then they fell to the horizontal situation, and thence gradually to the usual state of rest.

These experiments prove that the whole change is occasioned by *light* only. To put this beyond dispute, in the evening of the sixth day, the plant was set in a book-case, on which the morning sun shone, the doors standing open. The day was bright. The lobes, which had closed in the evening, began to open *early* in the morning, and by *nine o'clock*, they were raised in the usual manner. I then, says he, *shut* the doors of
the

the book-case : on opening them an hour after, *the lobes were all closed* as at midnight. On opening the door they expanded again, and in twenty minutes they were fully expanded. This has since been many times repeated, and always with the same success. We can therefore, by admitting or excluding the light, make the plant put on all its changes. Hence we are certain, that what is called *the sleep of plants*, is caused by the absence of *light* alone, and that their various intermediate states are owing to its different degrees.

Some experiments on plants give us reason to believe, that *light* combines with certain parts of vegetables, and that the green of their leaves, and the various colours of their flowers, is chiefly owing to this combination. This much is certain, that plants which grow in darkness are perfectly white, languid, and unhealthy, and that to make them recover vigour, and to acquire their natural colour, the direct influence of *light* is absolutely necessary.

It would be difficult, in the present state of chemical knowledge, to shew the combination of light with *our* bodies. But it cannot but be allowed, that *light* is a stimulus, awaking us to muscular action, and opening an
inlet

inlet to the stimulus of the various passions*, and more especially to the powerful influence of sight. The boy, who was couched for blindness by Mr. CHESELDEN, had no great expectation of pleasure from a *new sense*; he was only excited by the hopes of being able to read and write; he said, for instance, that he could have no greater pleasure in walking in the garden with his sight, than he had without it, for he walked there at his ease, and was acquainted with every turn. He remarked also, with great justice, that his former blindness gave him one advantage over the rest of mankind, which was that of being able to walk in the night, with confidence and security. But, when he began to make use of this new sense, he seemed transported beyond measure. The

* A thick and impenetrable cloud of *darkness* on a sudden enveloped the Grecian army, and *suspended* the battle. AJAX, perplexed what course to take, prays thus,

Accept a warrior's pray'r, eternal Jove;
This cloud of darkness from the Greeks remove,
Give us but *light*, and let us see our foes,
We'll bravely fall, tho' *Jove himself* oppose.

The sentiments of AJAX are here pathetically expressed: it is AJAX himself. He begs not for life: a request like that would be beneath a hero. But because in *that darkness* he could display his valour in no illustrious exploit, and his great heart was unable to brook a sluggish inactivity in the field of action, he only prays for *light*, not doubting to crown his fall with some notable performance, though *Jove himself* should oppose his efforts. LONGINUS.

brightness

brightness of the day, the azure vault of heaven, the verdure of the earth, the crystal of the waters, all employed him at once, and animated and filled him with inexpressible delight. He turned his eyes towards the sun. Its splendour dazzled and overpowered him: he shut them once more; and, to his great concern, he supposed that, during this short interval of *darkness*, he was returning to nothing. New ideas now began to arise; new passions, as yet unperceived, with fears, and pleasures, all took possession of his mind, and prompted his curiosity: love served to complete his happiness; and every sense was gratified in all its variety.

I had not, perhaps, been thus diffuse on the article of *light*, unless I had observed, that all animals, when afflicted with illness, fly instinctively to some *silent* and *dark* retreat, where, unaided by art, they quickly recover; and that man, left to the guidance of reason only, often falls short in this respect of the brute creation, and frequently his powers, already weakened by disease, get still the more *exhausted* by an imprudent admission of *company* and *light*.

Z

Every

Every one, who has experienced a nervous fever, says the benevolent Mr. TOWNSEND, must have felt the distress that is occasioned by *these stimuli* *.

* Vide *The Guide to Health*, Observation the Sixth, on LIGHT.

SECT.

SECT. VI.

ON AIR.

As this subject has been already treated of in Part II. of this work, I shall only recapitulate what has been before said, giving, however, *a few additional observations on the pernicious effects of BAD AIR.*

IN PART II. SECT. I. it was shewn, "*that air is absolutely necessary for the preservation of life.*"

IN SECT. II. it was shewn, *from the destruction in the prison of Calcutta, and the history of the Lying-in Hospital at Dublin, where, in a few years only, 4000 children unnecessarily perished, "that a due supply of air is indispensable."*

IN SECT. III. it was said, "*that atmospheric air consisted of two parts, of which one is called VITAL, because it contributes to life; the other AZOTIC, because, being respired by animals, it produces in a few minutes death.*" Thus when these two portions are separated, and confined within different jars; a mouse, or any other animal, will live a considerable time in the one, being lively, brisk, and active; whilst in the other he soon languishes and dies.

In SECT. IV. it was shewn, "*that the vital, or oxygen, portion of the atmosphere was by our breathing,*

1st, *Converted into FIXED AIR (oxygen air and charcoal thrown off from the blood), and*

2dly, *It was ABSORBED by the venal blood rendering it arterial blood, and*

3dly, *That the oxygen or vital portion of the air being altered or absorbed, nothing but an atmosphere of FIXED and AZOTIC AIRS was left behind, both of which are incapable of supporting life."*

In SECT. V. "*The animal machine was compared to a clock: the wheels whereof may be in ever so good order, the mechanism complete in every part, and wound up to the full pitch; yet without some impulse to the PENDULUM, without the incessant stimulus of vital or oxygen air in the blood, which alone sets the HEART a going, the whole would remain motionless."*

That air is a *stimulus* to the heart and arteries in proportion to the OXYGEN AIR it contains (the effects of temperature has been before considered), is proved in several sections in Part II *. We need therefore only introduce here the language of Dr. THORNTON to Dr. BEDDOES, who says, "How great an advantage does

* See note *, page 110,

the knowledge of the *composition* and *effects* of air promise to the world, since, by means of MODIFIED AIR under the conduct of the *judicious* physician, the *actions* the *vital organs* may be *quickened* or *retarded*, and the *secretions changed*."

Having sufficiently explained the *stimulating effects* of a *pure atmosphere*, we will now contemplate, for a few minutes, the effects of an *impure* or *noxious air*.

The question whether putrid marshes are, or are not, unwholesome, is of considerable moment; Dr. PRIESTLEY, therefore, by a clear and conclusive experiment, has proved, that the vapour which arises from putrid water is *exceedingly noxious*, and thus guards us against the mischief which might otherwise proceed from a careless belief of the opposite opinion. Happening, says Dr. PRIESTLEY, to use at *Calne* a much larger trough of water, for the purpose of my experiments, than I had done at *Leeds*, and not having fresh water so near at hand as I had there, I neglected to change it, till it became offensive, but by no means to such a degree, as to determine me from not making use of it. In this state of the water, I observed bubbles of air to rise from it, and especially in one place, to which some shelves, that

I had in it, directed them; and having set an inverted glass vessel to catch them, in a few days I collected a considerable quantity of this air, which issued spontaneously from the putrid water; and putting *nitrous air** to it, I found that no *change of colour* or *diminution* ensued, so that it must have been in the highest degree *noxious*.

The celebrated Dr. FRANKLIN has likewise pointed out the pernicious effects of air from stagnant waters. Speaking of the flame which may be lighted up on the surface of some waters in *America*: I have frequently, says this excellent philosopher, tried the experiment in *England*. One day being employed in stirring up the stagnant water at the bottom of a deep ditch, I was seized soon after with an *intermitting fever*, which I can ascribe to no other cause, than to my breathing too much of that *foul air* which I stirred up from the bottom, and which I could not avoid while I stooped in endeavouring to kindle it.

Contagion is the inseparable attendant on the PLAGUE, or PUTRID FEVER. The winds may diffuse *the subtle venom*; but, unless *the atmosphere* be previously *disposed* for its reception, they would soon expire in the cold and temperate climates of the earth.

* See page 59.

Such was the *universal corruption of the air*, that the pestilence which burst forth in the fifteenth year of JUSTINIAN was not *checked* or *alleviated* by any *difference of the seasons*. In time its first malignity was abated and dispersed; the disease alternately languished and revived; but it was not till the end of a calamitous period of *fifty years* that mankind recovered their health, and *the air* resumed its pure and salubrious quality.

No facts have been preserved to sustain an account, or even a conjecture, of the numbers that perished in this *extraordinary mortality*.

I only find, says our elegant historian *, that during three months 5,000, and at length 10,000 persons died each day at CONSTANTINOPLE,—that many cities of the EAST were left vacant,—and that in several districts of ITALY the harvest and the vintage withered on the ground.

In 1720, *the plague* swept away from MARSEILLES 50,000 inhabitants, though this city contains at present no more than 92,000 souls.

In that great *plague* which desolated the city of LONDON, the constitution of the air previous to it was singular:—a *hard frost* during the winter, lasting till near

* GIBBON.

the end of March,—a *sudden thaw*,—the ground covered with *water* from melted snow and ice,—and *great heats* succeeding;—men were living, as it were, in a room flooded with *water*, with a *great fire*.

As soon as the nature of the disease was known, 40,000 servants were dismissed, and turned into the streets to perish, for no one would receive them into their houses; and the villagers near London drove them away with pitch-forks and fire-arms.

Sir JOHN LAWRENCE, “London’s generous mayor,” supported them all, as well as the needy who were sick, at first by expending his own fortune, till subscriptions could be solicited and received from all parts of the nation.

HE

“Raised the weak head, and stayed the parting sigh,

“Or with new life resumed the swimming eye.”

Dr. DARWIN.

A pit 40 feet long, 16 feet wide, and about 20 feet deep, was dug in the CHARTER-HOUSE, and in two weeks it received 1,114 bodies.

During this dreadful calamity there were instances of mothers carrying their own children to those public graves, and of people delirious, or in despair for the loss of their friends, who *threw themselves alive into these pits*.

“One

" One smiling boy, her last sweet hope, she warm'd,
 " hush'd on her bosom, circled in her arms,
 " Daughter of woe!—ere morn, in vain carefs'd,
 " clung the cold babe upon thy milkless breast,
 " with feeble cries thy *last sad aid* required,
 " stretch'd its stiff limbs, and on thy lap expired!"

— — — — —
 — — — — —
 " Long with wide eye-lids on her child she gazed,
 " and long to heaven their tearless orbs she raised;
 " Then with quick foot and throbbing heart she found
 " where CHARTREUSE open'd deep his holy ground;
 " Bore her last treasure through the midnight gloom,
 " and kneeling dropp'd it in the mighty tomb;
 " *I follow next!* the frantic mourner said,
 " and living plunged amid the the festering dead."

DARWIN.

A pious and learned schoolmaster, who ventured to
 stay in the city, and took upon himself the humane of-
 fice of visiting the sick and dying, who had been deserted
 by better physicians, averred, that being once called to
 a poor woman, who had buried her children of the
 plague, he found the room where she lay so little that it
 scarce could hold any more than the bed whereon she
 was stretched. However, in this wretched abode, beside
 her, in an open coffin, her husband lay, who had some
 time before died of the same distemper; and whom she,
 poor creature, soon followed.

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What shewed the peculiar *malignity* of the air, thus suffering from human miasmita, or effluvia, was, that the contagious *steams* had produced SPOTS on the very wall of their wretched apartment : and Mr. BOYLE's own study, which was contiguous to a pest-house, was also spotted in the same *frightful manner* *.

In the year 1793, the manufactures, trade, and commerce, of PHILADELPHIA, were flourishing in the greatest degree. The number of coaches, chairs, &c. lately set up in that city by men in the middle rank of life, is hardly to be believed. And although there had been a very great increase of hackney chairs, yet was it next to impossible to procure one on a Sunday, unless it was engaged two or three days beforehand. Luxury, the usual, and perhaps inevitable concomitant of prosperity, had eradicated the plain and wholesome manners of an infant town. Every one looked forward to the full harvest of prosperity. But how fleeting are all human views ! how uncertain all plans founded on earthly appearances ! All these flattering prospects, as Mr. CAREY beautifully expresses it, vanished like the baseless fabric of a vision.

In July 1793 arrived the unfortunate fugitives from Cape Francois. And on this occasion, the liberality
of

* GOLDSMITH.

of PHILADELPHIA was displayed in a most respectable point of view. Nearly 12,000 dollars were in a few days collected for their relief. Little, alas! did many of the contributors, then in easy circumstances, imagine, that a few weeks would leave their wives and children dependent on public charity, as has since unfortunately happened. An awful instance of the rapid and warning vicissitudes of affairs on this transitory stage.

At this seemingly propitious moment, the *destroying scourge** crept in among us, and nipped in the bud the fairest blossoms of hope. And, oh! what a dreadful contrast suddenly took place!

Dismay and affright are visible in every one's countenance. Most people, who can by any means make it convenient, are flying from the city. Of those who re-

* The privateer SANS CULOTTES MARSEILLOIS, with her prize the FLORA, which arrived the 22d of July, introduced the *contagious fever*. The privateer was in a foul, dirty condition, her hold was small, and perhaps as ill calculated for the accommodation of the *great number of people* that were on board, as any vessel that ever crossed the ocean. All her filth was emptied at a wharf between Arch and Race-street. A dead body, supposed to have died of A FEVER, covered with canvals, lay on board the FLORA, for some time, and was seen by Mr. Lemaigue, and other gentlemen. It is certain that the mortality began about that part of Water-street where the MARY, the FLORA, and the SANS CULOTTES lay. Almost every death which at first occurred could be without difficulty traced to that street. Some French lads were also among the earliest victims.

main, many have shut themselves up in their houses, and are afraid to walk the streets. Those who venture abroad, have handkerchiefs or sponges impregnated with vinegar or camphor perpetually at their noses, or else are smelling at bottles with the thieves' vinegar. Others carry pieces of tar in their hands or pockets, or camphor bags tied round their necks. Many never walk on the foot path, but go into the middle of the streets to avoid being infected in passing houses wherein people have died. Acquaintances and friends avoid each other in the streets, and only signify their regard by a cold nod. Every one appears to shift his course at the sight of a hearse coming towards him. A person with a crape, or any appearance of mourning, is shunned as a viper. Indeed it is probable LONDON did not exhibit stronger marks of terror, than were seen in PHILADELPHIA from about the middle of August till pretty late in September. Many of our first commercial houses are totally dissolved, by the death or flight of the parties, and their affairs necessarily left in so deranged a state, that the losses, and protests of notes, which have ensued, are beyond estimation.

While affairs were in this deplorable state, and people at the lowest ebb of despair, we cannot be astonished at
the

the frightful scenes that were acted, which seemed to indicate a total dissolution of the bonds of society in the nearest and dearest connexions. Who, without horror, can read of a husband deserting his wife, united to him perhaps for twenty years, in the last agony ;—a wife unfeelingly abandoning her husband on his death-bed ;—parents forsaking their children :—children ungratefully flying from their parents, and resigning them to chance ;—masters hurrying off their faithful servants to the hospital, established out of the town, even on suspicion of the fever, and that at a time when, like Tartarus, it was open to every visitant, but never returned any ;—servants abandoning tender and humane masters, who only wanted a little care to restore them to health and usefulness ;—who, I say, can even now reflect on these things without horror ? Yet such were the daily spectacles exhibited throughout our city. Many men of affluent fortunes, who have given employment and sustenance to multitudes, have been abandoned to the care of a hired negro, after their wives, children, friends, clerks, and servants, have fled away, and left them to their fate. With the poor the case was, as might be expected, infinitely worse. Many of these have perished without a human being to hand them a little water,

to

to administer medicines, or perform any charitable office for them. Various instances occur of dead bodies found lying in the streets, of persons who had no house of their own, and looking ill, could procure no shelter.

The number of the infected daily increasing, and every one afflicted with this disease being refused admittance into the alms-houses, as some temporary place was requisite, three of the guardians of the poor took possession of *the Circus*, in which Mr. Ricketts had lately exhibited his equestrian feats, being the only place that could be procured for the purpose. Thither they sent seven persons afflicted with the malignant fever, where they lay in the open air for some time, without assistance, for nurses could not be procured them, though high wages were offered. Of these, one crawled out on the common, where he died at a distance from any house. Two died in the Circus, one of whom was seasonably removed, the other lay in a state of putrefaction for above forty-eight hours, owing to the difficulty of procuring any person to remove him.

The inhabitants of the neighbourhood of the Circus took the alarm, and threatened to burn or destroy it, unless the sick were removed; and it is believed they would

would have actually carried their threats into execution, had a compliance been delayed a day longer.

A servant girl, belonging to a family in this city, in which the fever had prevailed, was apprehensive of danger, and resolved to remove to a relation's in the country. She was, however, taken sick on the road, and returned to town, where she could find no person to receive her. One of the guardians of the poor provided a cart, and took her to the alms-house, into which she was refused admittance. She was brought back, and the guardians offered five dollars to procure her a single night's lodging, but in vain. And, in fine, after every effort to provide her shelter, she absolutely expired in the cart.

To add to the dreadful affliction of the inhabitants of PHILADELPHIA, the alarm was spread throughout the different states of America. The inhabitants of NEW YORK first came to a resolution to stop all intercourse with the infected city; and for this purpose guards were stationed at the different landings, with orders to send back every person coming *from* PHILADELPHIA. All persons taking in lodgers, were called upon to give information of all people of every description, under pain of being prosecuted according to law. All *good* citizens

were required to give information to the mayor, of any breach of these premises.

All these strict precautions being eluded by the anxious fugitives from PHILADELPHIA, there was a second meeting held, of the delegates from the several wards of the city, in order to adopt more effectual methods. At this meeting, it was resolved to establish a night watch of not less than ten citizens in each ward, to guard against such as might escape them by day. Not yet eased of their fears, they next day published an address, in which they mentioned, that notwithstanding their utmost vigilance, many persons had been *clandestinely* landed upon the shores of NEW-YORK ISLAND. They therefore again called upon their fellow citizens to be cautious how they received strangers into their houses; not to fail to report all such to the mayor immediately upon their arrival; to remember *the importance of the occasion*; and to consider *what reply they should make to the JUST resentment of their fellow citizens, whose lives they might expose by a criminal neglect and infidelity*. They likewise resolved, that they would consider and publish to the world, as *enemies to the welfare of the city*, and the lives of its inhabitants, all those who should be so selfish and

and hardy, as to attempt to introduce any goods, wares, merchandizes, bedding, baggage, &c. imported from, or packed up in, PHILADELPHIA, contrary to the rules prescribed by that body, who were, they said, deputed to express the will of their fellow citizens.

While our citizens were thus, continues Mr. CAREY, proscribed in several cities and towns,—hunted up like felons in some,—and debarred admittance and turned back in others, whether sound or infected,—it is with extreme satisfaction I am able to record a few instances of a contrary procedure.

A respectable number of the inhabitants of *Springfield*, in NEW JERSEY, after a full consideration of the distresses of our citizens, passed a resolve, offering their town as an asylum to the people flying from PHILADELPHIA, and directing their committee to provide a suitable place, as an hospital, for such of them as might be seized with the prevailing *malignant fever*. An asylum was likewise offered to the Philadelphians by several of the inhabitants of *Elkton*, in MARYLAND; and the offer was couched in terms of the utmost sympathy for the distresses of the *Philadelphians*.

At this time the disorder was raging with increasing vehemence. By order of the mayor the bells were stop-

ped from tolling. This was a very expedient measure; as they had before been kept pretty constantly going the whole day, so as to terrify those in health, and drive the sick, as far as the influence of imagination could produce that effect, to their graves. An idea had gone abroad, that the burning of *fires* in the streets would have a tendency to purify the air, and arrest the progress of the disorder. The people had, therefore, almost every night large fires at the corners of each street. The mayor published also a proclamation forbidding this dangerous practice. As a substitute, many had recourse to the firing of *guns*, which was imagined a sure preventative of the disorder. This was carried so far, and attended with so great noise, that it was also forbidden by an order from the mayor.

The situation of the *public hospital* was most dreadful. A profligate and unfeeling set of nurses (none of good character could be procured at this moment) rioted on the provisions and comforts prepared for the sick, who (unless at the hours the doctors attended) were left almost entirely destitute of every assistance. The dying and dead were indiscriminately mingled together. The ordure and other evacuations of the sick were often allowed from inattention to remain. Not the smallest

order or regularity existed. It was, in fact, a great *human slaughter-house*, where numerous victims were immolated at the altar of riot and intemperance. No wonder, then, that a general dread of the place prevailed throughout the city, and that a removal to it was considered as the seal of death. In consequence, there were various instances of sick persons locking their rooms, and resisting every attempt to carry them away. At length the poor were so much afraid of being sent to BUSH-HILL, that they would not acknowledge their illness, until it was no longer possible to conceal it. For it is to be observed, that the fear of the contagion was so prevalent, that as soon as any one was taken sick, an alarm was spread among the neighbours, and every effort was used to have the sick person hurried off to BUSH-HILL, to avoid spreading the disorder. The cases of poor people forced in this way to that hospital, though labouring under only common colds, and common fevers of irritation, are numerous and afflicting. There were not wanting instances of persons, only slightly ill, being sent to BUSHHILL, by their panic-struck neighbours, and embracing the first opportunity of running back to PHILADELPHIA.

At this time a circumstance however occurred, which

alone would be sufficient to rescue the character of man from obliquy and reproach. As a human being, I rejoice, says the benevolent Mr. CAREY, that it has fallen to my lot, to be a witness and recorder of the fact. STEPHEN GERARD, a *wealthy* merchant, and native of *France*, touched with the wretched situation of the sufferers at BUSHHILL, voluntarily and unexpectedly offered to superintend that hospital. The surprise and satisfaction excited by this extraordinary effort of humanity, can be better conceived than expressed. PETER HELM, a native of *Pensylvania*, actuated by the like benevolent motives, offered his services also in the same department.

To form a just estimate of the value of the offer of these good men, it is necessary to take into full consideration the general consternation, which at that period pervaded every quarter of the city, and which made attendance on the sick be regarded little less than *certain sacrifice*. Uninfluenced by any reflections of this kind, without any possible inducement, but the purest motives of humanity, they came forward, and undertook what would by *others* be deemed a forlorn hope. They underwent a laborious round of duty. They incessantly encouraged and comforted the sick, they gave them necessities

cessaries and medicines, they even performed many disgusting offices of kindness, which nothing could render tolerable, but the exalted motives that impelled them to *this heroic conduct*.

On the contrary, *the jail* of PHILADELPHIA is under such excellent regulations, that the disorder made its appearance there only in two or three instances, although such abodes of misery are the places where contagious disorders are mostly generated. When this putrid fever raged most violently in the city, there were in the jail one hundred and six French soldiers and sailors, confined by the order of the French consul, besides eighty convicts, vagrants, and persons for trial; all of whom except two or three remained perfectly free from the complaint. Several circumstances conspired to produce this salutary effect.

The people confined are frequently cleansed and purified by the use of the hot and cold bath;—they are kept constantly employed;—vegetables form a considerable portion of their diet;—in the yard vegetation flourishes;—and many of them being employed in stone cutting, the water, constantly running, keeps the *atmosphere* in a *moist* and *pure* state. Whereas the inhabitants of dirty and confined streets have severely expiated their neglect

neglect of cleanliness and decency, by the number of them that have fallen sacrifices. Whole families in such houses have sunk into one silent and undistinguished grave.

As I have been obliged to note a variety of horrid circumstances, which have a tendency to throw a shade over the human character, it is proper to reflect a little light on the subject, wherever justice and truth will permit it. Here it ought to be recorded, that some of the convicts in the jail voluntarily offered themselves as *nurses* to attend the sick at BUSHHILL, and have in that capacity conducted themselves with so much fidelity and tenderness, that they have had the repeated thanks of the managers.

In the progress of this disorder, from the numerous deaths of heads of families, a great number of children were left in a most abandoned and forlorn state. The bettering houses, in which such helpless subjects have been usually placed, was barred against them. Many of these little innocents were actually suffering for want of even common necessaries. The deaths of their parents and protectors, which should have been the strongest recommendation to public charity, was the very reason of their distress, and of their being shunned

as

as a pestilence. The children of a family, once in affluent circumstances, were found, their parents being dead, in a blacksmith's shop, squalid, dirty, and half starved, having been for a considerable time without even a taste of bread. This early caught the attention of the humane, and 160 children were soon rescued from this forlorn condition, and lodged in a building called the *Loganian Library*.

Rarely has it happened, that so large a proportion of the gentlemen of the faculty have sunk beneath the labours of their very *dangerous profession*, as on this occasion. In little more than a month, exclusive of medical students, no less than *ten physicians* have been swept off. Hardly any of the *apothecaries*, who remained in the city, escaped from indisposition. The venerable SAMUEL ROBESAN has been, like a good angel, indefatigably performing, in families where there was not one person able to help another, even the menial offices of the kitchen, in every part of his neighbourhood. JOHN CONNELLY has spent hours beside the sick, when their own wives and children had abandoned them. Twice did he catch the disorder,—twice was he on the brink of the grave, which was yawning to receive him,—

*

yet,

yet, unappalled by the imminent danger he had escaped, he again returned to the charge.

To habits *defectively* OXYGENATED, as with tiplers, and drunkards, and men of a corpulent habit, and women with child, this disorder proved very *fatal*. Of these many were seized, and the recoveries were very rare*.

If you examine the register of the weather, you will find there was *no rain* from the 25th of August until the 14th of October, except a few drops, hardly enough to lay the dust in the streets, which fell on the 9th of September, and the 12th of October. In consequence of which, the springs and wells failed in many parts of the country. The dust in some places extended two feet below the surface of the ground. The pastures were deficient, or burnt up, and there was a scarcity of autumnal fruits in the neighbourhood of the city. The register of the weather shews also *how little* the air was agitated by winds during the above time. In vain were the changes of the moon expected to alter the state of the atmosphere. The light of the morning, as constantly mocked the

* Vide the Section on Fevers, in Part IV. ON THE NATURE OF DISEASES, AND THEIR PROPER TREATMENT.

hopes,

hopes, which were raised by a cloudy sky in the evening. Hundreds sickened each day beneath the influence of the sun; and even when his beams did not excite disease, they produced a languor in the body, and to use the country phrase, the labourer in the field gave in, and that too when the mercury in the thermometer was under 80 degrees. On the 12th of September a *meteor* affrighted the inhabitants. *Muschetoes* were uncommonly numerous. Here and there a dead cat added to the impurity of the air of the streets; for many of those animals perished with hunger in the city, in consequence of so many houses being deserted by the inhabitants who had fled into the country.

However inoffensive uniform heat, when agitated by gentle breezes, may be, there is I believe no record, where a dry and stagnating air has existed for any length of time without producing disease. HIPPOCRATES, in describing a pestilential fever, says, the year in which it prevailed was without a breeze of wind. The same state of the atmosphere for six weeks, is mentioned in many of the histories of the plague which prevailed in London in 1665. Even the sea air itself becomes unwholesome by stagnating; hence Dr. CLARK informs us, that sailors become sickly after long calms in their voyages to the

From this table it appears that the principal mortality was in the second week of October. A general expectation had obtained, that *cold weather* was as destructive of the contagion of this fever as *heavy rains*. The usual time for its arrival had come, but the weather was still not only moderate, but warm. In this awful situation, the stoutest hearts began to fail. Hope sickened, and despair succeeded distress in almost every countenance. On the 14th of *October* it pleased God to alter the state of the air. The clouds at last dropped health in *showers* of rain, which continued during the whole day, and which were succeeded for several nights afterwards by *cold and frost*. The effects of this change in the weather, appeared first in the sudden diminution of the sick, for the deaths continued for a week afterwards to be nearly as numerous, but they were of persons who had been confined before, or on the day in which the change had taken place in the weather.

The appearance of this *rain* was like a dove with an olive branch in its mouth, to the whole city. Public notice was given of its beneficial effects in a letter subscribed by the mayor of Philadelphia, who acted as president of the committee, to the mayor of New York.

To

TO RICHARD VANCHE, ESQ.

"Sir,

"I am favoured with your letter of the 12th instant, which I have communicated to the Committee.

"The part, Sir, which you personally take in our afflictions, and which you have so pathetically expressed in your letter, excites in the breasts of the Committee the warmest sensations of affection. The subscription made in NEW YORK is a balm to the sores of our distressed city.

"I am overjoyed as I inform you, that the refreshing rain which fell on the 14th, though light, and the cool weather which hath succeeded, appear to have given a check to the prevalence of the fever. Few since appear to have taken the infection; the applications for the hospital are few, and the funerals are decreased.

"With sentiments of the greatest esteem and regard, &c."

On the 30th and 31st of October there was a considerable fall of rain. The fever was in consequence wholly subdued. A visible alteration soon took place in the city. Every hour long absent and welcome faces appear,—and in many instances, those of persons whom public fame has buried for weeks past. The stores, so long closed, are opening fast. Some of the country merchants, bolder than the rest, are daily venturing into their old place of supply. Market-street is almost as full of waggons as usual. The Custom-house, for weeks nearly deserted by our mercantile people, is thronged by citizens entering their vessels and goods:—the streets too, long the abode of gloom and despair, have assumed the bustle suitable to the season. The arrival in the city of our beloved President, continues Mr. CAREY, gives us a
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flattering

flattering prospect of the next session of congress being here. And, in fine, as every thing in the early stage of the disorder, seemed calculated to add to the consternation; so now, on the contrary, every circumstance has a tendency to revive the hopes and happiness of our afflicted city*.

In the year 1732-3, there happened throughout Europe an *epidemic* of a most dreadful nature.

The *previous constitution of the air* occasioned a great drought, which may be inferred from the failure of the springs, and the abatement of fresh water in all its usual currents and reservoirs.

In ENGLAND we had little if any frost; great *fogs* were much noticed in GERMANY and FRANCE.

In the *latter* kingdom there was, about Christmas, a trifling fall of snow. This was succeeded with constant *southerly winds*, and *offensive fogs*, during which there was observed by some surgeons a great disposition in wounds to *mortify*.

Both *before* and *during* the continuance of the *epidemic* in ENGLAND the air was *unusually warm* for the time of the season, with *storms* of wind from the south-west, *lightnings*, and *thunder*.

* This fever swept off about 4,000 persons. Vide note *, page 41.

The *time of invasion* was different in different countries.

An *uniformity of symptoms*, however, was remarkable every where.

A *small rigour* or *chilliness*,—succeeded by a *fever* of a duration (in such as recovered) seldom above three days.

This *fever* was attended with *headach*,—*pains along the back*,—*slight thirst*,—*sneezing*,—*a thin defluxion from the nose and eyes*,—*a cough*, with *expectoration of phlegm*, and when this matter became purulent, the disease proved fatal.—The *cough* continued with some six weeks or two months.

This *epidemic* invaded SAXONY, and the neighbouring countries in GERMANY, about the fifteenth of November.

It was *earlier* in HOLLAND than in ENGLAND; *earlier* in EDINBURGH than in LONDON.

It was in NEW-ENGLAND before it attacked BRITAIN; in LONDON before it reached some other places *westward*, as OXFORD, BATH, &c.—and, as far as I can collect from accounts, it invaded the *northerly parts* of EUROPE before the *southerly*.

It lasted in its vigour in LONDON—from about the middle of *January* 1733 for about *three* weeks:—the Bills of MORTALITY, from *Tuesday* the 23d, to *Tuesday* the 30th of January, contained 1,588 persons, being higher than any time since the plague.

There was, during the whole season, a great run of hysterical, hypochondriacal, and nervous distempers.

I shall only add, that the *horses* were seized with the *catarrh* before men, and that *dogs* were reported to have gone mad long before the autumn.

The epidemic catarrh, whenever it appears, spreads, from province to province, till it has extended over Europe, or even crossed the Atlantic to America. A few years back I had, says the Rev. Mr. TOWNSEND, a most striking demonstration of its progressive march. I was at *St. Agnes*, in Cornwall, but before it reached us I removed with all my family to *Lanlivery*. There we continued safe, whilst the disease was spreading in the parish of *St. Agnes*; and on our return we found that few persons had escaped, but that it had quitted them, and was extending westward to the extremity of Cornwall.

Dr. CULLEN has collected a register of epidemical catarrhs to the amount of twenty-five, between the years

1323 and 1767: but other practitioners have greatly increased this list.

Lime-kilns throw off large quantities of *fixed air*; and those who incautiously lay themselves down either on the walls of the kiln, or so near as to be exposed to the vapour which rises from the burning lime-stone, often experience its pernicious effects. Some years ago, I remember a poor family, says Dr. FALCONER of Bath, who lodged in a room adjoining to a lime-kiln; during the night, the vapour of the burning lime made its way into the room, and the four persons of which the family consisted were all killed. In the morning they were found lying as in a composed sleep, without any appearance of having gone through either pain or struggle.

In the spring of the year 1778, two disorderly young women, after rambling about the town for a considerable part of the night, crept early in the morning into a little hovel which was contiguous to a *lime-kiln*. The kiln was charged and burning, and the vapour of the lime was forced through some crevices into the hovel. After some hours, the man who had the care of the kiln came to look after his work, and finding these women as he supposed asleep, went away without disturbing them. Some time after he returned, and seeing them
still

still in the same place, endeavoured to awaken them, but in vain; they were cold and motionless. In one there did not appear to be the least remains of life; and in the other there was only a slight and indistinct movement about the heart. This patient was soon conveyed to the hospital. By proper means she was recovered, and ran away from the hospital, without expressing the least sense of gratitude for the care and humanity which had been exercised towards her. The other was not conveyed to the hospital so early, and the same means were used, but without success.

The most neat and delicate person, after having passed the night in his bed-chamber, does not, when he awakes, discover any faint smell in his room: but if he quits it only for a few minutes, and returns to it, after having been in the open air, and before fresh air has been admitted, he will quickly discern an essential difference.

If these evils arise from animal effluvia, in apartments frequented by the opulent, nice, and elegant, who have the means and disposition to promote neatness and cleanliness; how much more injurious must *stagnant air* be in the hovels of the indigent, who are destitute of all the conveniences, and many of the necessaries, of life.

In

In order to be satisfied of the truth of this observation, we need only look into the great manufacturing towns, where we shall find a *puny degenerate* race of people, *weak* and *sickly* all their lives, seldom exceeding the middle period of life; or if they do, being unfit for business, they become a burthen to society. Thus arts and manufactures, though they may increase the *riches* of a country, are by no means favourable to the *health* of its inhabitants.

UNWHOLESOME AIR, says Dr. BUCHAN, author of the Domestic Medicine (a work shewing accurate observation, and great experience, but *incapable of forming the practitioner* *), is a very common cause of disease.

* This work always puts me in mind of the *Edinburgh Pharmacopœia Pauperum*, and the *Hereditary Shop* I found in *Ireland* where each drawer containing medicines was carefully labelled. "FOR FEVERS, FITS, SORE EYES, &c.!" When Dr. ———, who gave his advice for one shilling, died at Marlborough, his STABLE-BOY married his widow, and continued in his house, and therefore naturally succeeded to his business. Unfortunately the prescription-book of the deceased was not *titled*, and a patient would therefore frequently come for a cure of the *gripes*, and he was given JALAP; for *vomiting*, and he had ANTIMONIAL WINE; for *pain in the stomach*, whether arising from *wind* or *inflammation*, and he had PEPPERMINT WATER; and the doses were *the same*, however the constitutions might *differ*. The late celebrated Dr. HUGH SMITH used to *rob* a man of an *imposing countenance*, who, when he was absent at a fox-chase, heard his *home patients* with significant attention, and

disease. Few, says he, are aware of the danger arising from *bad air*. People generally pay some small attention to what they eat and drink ; but seldom regard what goes *into the lungs*, though the latter proves often more suddenly fatal than the former.

and would take out the Doctor's prescription, which was previously written, and *receive the fee*. When a *stranger* came on such days he was desired to go to the *PLACEBO* drawer in the next room. Seeing, at last, *How EASY IT WAS TO BE A DOCTOR*, *this man* transcribed *these formula*, and set up for himself. But being afterwards taken very bad, he did not hazard *on himself* one of the *stolen formula*, and fortunately for society he was taken off by this disease, but not *before* he had set up *his chariot*. *SMITH'S FORMULA* are now published, and was bought lately at an auction, lotted with *KILLING NO MURDER*, for *two shillings*.

The province of every teacher of physic is to discover and explain the *causes* of disease, as well as the *remedies*. Thus *JAUNDICE* is an *obstruction of the gall duct*. This duct is of the size of a crow quill. It may be obstructed,

CAUSES.	REMEDIES.
1. by <i>spasm</i> , - - -	1. Antispasmodics.
2. by <i>gall stones</i> , - - -	2. The warm bath, emetics, bleeding.
3. by <i>viscid mucus</i> , - - -	3. Alkaline remedies.
4. by <i>hardened feces</i> , - - -	4. Laxatives.
5. by an <i>induration of the liver</i> , -	5. Small doses of mercury.
&c. &c.	

As there are five *causes* of this disease enumerated, no *one remedy* is a *specific*, applicable to every case of jaundice, and it is therefore at least *four to one* against the patient in the hands of an unskilful practitioner. This equally applies to every other disease. Dr. ROWLEY describes no less than *ONE HUNDRED and EIGHTEEN principal diseases of the eye*. Neither is *knowledge sufficient of itself*: for I doubt much whether even Sir ISAAC NEWTON would have supplanted the simple *steersman* in the conduct of a vessel.

If *fresh air*, continues this benevolent, but unphilosophic writer, be necessary for persons in health, it is still more so for such as labour under disease, who often lose their lives by those methods, which an over anxious care too frequently contrives in the chambers of the sick. The notion that *their* rooms must be kept very close, is so common that *we* can hardly enter the chamber, where a patient lies, without being ready to faint, from the *noxious air* in the room. How this must act on *the sick* is left for the discerning to judge. To me, it appears, says he, that no medicine is so beneficial as a *cautious and distant admission of fresh air*. WHEN ADMINISTERED WITH PRUDENCE IT IS THE MOST REVIVING OF ALL CORDIALS.

SECT.

SECT. VII.

ON EXERCISE.

THIS subject has been already considered in a philosophic point of view in Sect. XII. page 126.

It was there shewn, that when muscular intumescence took place, certain chemical combinations were formed, productive of the VITAL FLAME.

If I walk slowly along, for the space of a quarter of a mile upon even ground, my *breathing* and *pulse* are but little accelerated, and *the heat* of my body remains nearly the same as before. But if I walk at the same pace, and for the same distance, up a *steep hill*, or bearing a *heavy burthen*, my *breathing* becomes *short* and *full*, and my *heart* beats *strong* and *quick*, and *the heat* thrown off from my body corresponds with these increased internal movements.

It is natural to ask, what is the cause of this *difference*, when the *space*, the *speed*, and the *actual movement* of the muscles are the same? It certainly arises from the *quantity of nervous electricity* transmitted from the BRAIN to the muscles in the *latter case*, where the body was

raised on high, or where a *weight* was carried, being *much greater* than when the body is *only moved*, without being lifted up, or without any additional weight upon it. For though the *motion* of the muscles be the *same* in both cases, yet the *increased* weight to be moved, required the *nervous exertion* to be much *greater* in the latter instance than in the former; and therefore the *will*, or *determination of the mind*, propelled a *greater quantity* of *nervous electricity*, from the BRAIN to the muscles employed.

To the increased demand on the system of OXYGEN AIR, to be *decomposed* by the *nervous electricity**, the accelerated *respiration* must be attributed; and from the increased quantity of OXYGEN AIR in the blood, we can account for the improved *digestion*†, and a more rapid *circulation*; and from all these causes, concurring with the *electricity* of the nerves, we are able to see clearly the reason of the increase of the *vital flame*.

* The *oxygen air* thus procured to the blood from the *want* of the system, is said to proceed from the *vis medicatrix nature*, and by others from *association* or *sympathy*. Thus the call of the stomach for food after a fever does not arise from the stimulus of the gastric juice, but from the *want* of the system. Thus a stimulus on the Schneiderian membrane of the nose occasions *sneezing*, &c. &c.

† Vide Sect. VIII. on the Balance betwixt Respiration and Digestion.

Observation 1. If an animal, a man, for instance, in good health, be exposed to a *temperate air*, in a state of *rest*, the quantity of *vital heat*, generated by the continued attractions of OXYGEN going on in the body, will be sufficient, with a certain quantity of clothing, for maintaining the temperature of about 97 degrees, by which the solids receive their natural stimulus, the fluids retain their proper fluidity, and all the functions of life are duly performed, and a sufficient quantity abounds to carry off the perspirable fluid.

Observation 2. If a man, exposed to a *frosty air*, continues at rest, the principles in his body attractive of OXYGEN, cannot generate a sufficient quantity of *vital heat* to keep every part of the body at its right temperature; because the coldness of the surrounding medium carries off *the heat* faster than *they* can produce it; consequently the solids and fluids of the extremities, and at the surface of the body, will become frigid, and the fibres torpid, and the death of the extreme, and lastly of the vital parts, ensue.

Observation 3. But, on the contrary, when a man exposed to a *frosty air*, perceives the coldness, and torpor, arising from his body being deprived of its heat, faster than the principles in his body attractive of OXYGEN

can furnish it; if he throws the *voluntary muscles* into action, the quantity of *heat* generated by the *nervous electricity*, will be sufficient to warm every part, and recover and maintain the natural temperature; although the air shall still continue to withdraw rapidly the *vital heat* from the surface of the body.

Some very pleasing experiments are related by Dr. PEART (whose name would be oftener mentioned with *still higher respect*, were we fortunate enough to rank him among the many illustrious converts to the *new chemistry*), which prove that *partial exercise* conveys a glow over the *whole body*.

I. EXPERIMENT.

I put my hand, says he, first into cold water at 56 degrees of temperature. After fifteen minutes I withdrew it, and found the temperature of the water raised to 65.

It had gained therefore, in fifteen minutes, 9 degrees of heat.

2. EXPERIMENT.

The same day I put my hand as before, but instead of keeping it, and my body, in a state of perfect rest, I

threw many of the voluntary muscles into action, and in fifteen minutes the water at 56 degrees was raised to 73.

Here it had gained 17 degrees of heat.

3. EXPERIMENT.

To prove that the exertion of any set of muscles affects the quantity of heat generated within, and thrown off from the whole body, I introduced my hand into the same quantity of water, and at the same temperature as in the first experiment, and I pushed my feet against a large book-case, firmly fixed by its own weight, and my arms were forcibly stretched out. By the exertion of these few muscles only, without any motion of the fibres, so much of the *electric fluid** was transmitted to these parts, and so much *heat* disengaged that *its stimulus* extended over the *whole body*, and the water in fifteen minutes rose in consequence to 14 degrees, that is, five degrees more than where the body was in a state of perfect rest †.

* Dr. PEART has the *nervous fluid*.

† The same is proved, though not quite so philosophically, by the vulgar mode of warming the *body* by throwing the *arms* across, or by the more elegant, but partial, exercise of what are called *dumb bells*.

To shew the absolute necessity of EXERCISE in cold climates, I must beg leave to relate the botanical excursion of Dr. SOLANDER, Sir JOSEPH BANKS, and others, on the heights at *Terra del Fuego*. Dr. SOLANDER, who had more than once crossed the mountains which divide Sweden from Norway, well knew that extreme cold produces a torpor and sleepiness almost irresistible, he therefore conjured the company to keep always IN MOTION, whatever pain it might cost them, and whatever relief they might be promised by an inclination to rest: "*Whoever sits down, says he, will sleep; and whoever sleeps, will wake no more.*" Thus, at once admonished and alarmed, they set forward; but while they were still upon the naked rock, and before they had got among the bushes, the cold was so intense, as to produce the effects that had been most dreaded. Dr. SOLANDER himself was the first who found the inclination, against which he had warned others, irresistible; and insisted upon being suffered to lie down. Mr. BANKS (now Sir Joseph Banks) intreated and remonstrated in vain: down he lay upon the ground, though it was covered with snow; and it was with great difficulty that his friend kept him from sleeping. One of his black servants also began to linger, having suffered from the cold in the same

same manner as the Doctor. Partly by persuasion, and partly by force, the company made them go forward. Soon, however, they both declared "they would go no farther." Mr. BANKS had recourse again to intreaty and expostulation, but these produced no effect: when the black was told, that if he did not go on he would in a short time be frozen to death; he answered, *that he desired nothing so much as to lie down and die*; the Doctor did not so explicitly renounce his life; he said he would go on, but that he must first take some "*sleep*," though he had before told the company that "*to sleep was to perish*." They both in a few minutes fell into a profound sleep, and after five minutes Sir JOSEPH BANKS happily succeeded in waking Dr. SOLANDER, who had almost lost the use of his limbs, and the muscles were so shrunk, that his shoes fell from his feet; but every attempt to relieve the unfortunate black proved unsuccessful.

It was a principle among the ancients, that *acute diseases* are from heaven, and *chronical* from ourselves; to die, says Dr. JOHNSON, is the fate of man, but to die with *lingering anguish* is generally his own folly. *Inactivity* never fails to induce an universal relaxation of the contractile fibres. When these fibres are relaxed, neither
the

the *digestion*, the *circulation*, nor the *peristaltic motion*, can be duly performed.

It is absolutely impossible to enjoy health, where the *perspiration* also is not duly carried on ; and that can never be the case where *exercise* is neglected.

The necessity of *action* is not only demonstrable from the fabric of the body, but evident from the observation of the universal practice of mankind, who for the preservation of health in those, whose rank or wealth exempts them from the necessity of lucrative labour, have invented sports and diversions, though not of equal use to the world with agricultural employments, yet of equal fatigue to those who practise them, and differing only from the drudgery of the husbandman, as they are acts of choice, and therefore performed without the painful sense of compulsion. The huntsman rises early, pursues his game, through all the dangers and obstructions of the chase, swims rivers, and scales precipices, till he returns home, no less harassed than the soldier, and has, perhaps, sometimes incurred as great hazard of wounds or death : yet he has no motive to excite his ardour ; he is neither subject to the commands of a general, nor dreads any penalties for neglect and disobedience ; he has
neither

neither profit nor honour from his perils and his conquest, but toils without the hopes of mural or civil garlands, and must content himself with the praise of his tenants and companions.

But such is the constitution of man, that *labour* may be styled its *own reward*; nor will any *external excitements* be requisite, *if* it be considered *how much happiness is gained*, and *how much misery escaped*, by frequent and violent agitation of the body.

The desire of *exercise* is *coeval* with life itself. Were this principle attended to, many diseases might be avoided. But, while *indolence* and *sedentary* employments prevent two thirds of mankind from either taking sufficient exercise themselves, or giving it to their children, what have we to expect but disease and deformity? The *rickets*, so destructive to children, called by the *French* the *English disorder*, never appeared in BRITAIN till manufactures began to flourish, and people, attracted by the love of gain, left the country to follow *sedentary* employments in great towns*.

Every animal makes an early use of its organs of motion; and many young creatures, even when under no

* Dr. BUCHAN.

necessity of moving in quest of food, cannot be restrained without force. This is evidently the case with the calf, the lamb, and the kitten. If these harmless animals were not permitted to *frisk* about and *take exercise*, they would soon die, or become diseased; and so strong is this *principle* implanted in the human breast, that a healthy youth can hardly be kept from exercise. This love of motion is surely a strong proof of its *utility*. Nature implants no disposition *in vain*. It seems a catholic law throughout the whole brute creation, that no creature, without *exercise*, shall be able to find subsistence. Every creature, except man, takes as much exercise as his nature requires. He alone sleeps till late in the morning in beds of down, and often lolls all day in easy chairs, and, deviating from the great law of his Creator, he suffers accordingly.

If fashion must prevail, and young children be sent to *crowded* schools, we would recommend it to their teachers, as *they value the lives of those entrusted to their care*, and *the account they must one day give*, that they would allow their pupils a sufficient time to *run* and *frisk* about, instead of keeping them HOUR AFTER HOUR in close and irksome confinement, which subjects them to a dreadful train of disease, flatulence, indigestion, colics,

worms, &c. &c. and hinders them hereafter from being *happy* and *useful* members of society. From *this criminal folly*, says the emphatic Dr. JOHNSON, proceed most of those pains which wear us away slowly with periodical tortures, and which, though they sometimes suffer life to be long, condemn it to be useless, chain us down to the couch of misery, and mock us with the hopes of death.

Certainly man was never designed to be sitting all day *cross-legged* on a board. The *master*, who denies a sufficient time for *exercise* to those unhappy beings, whom PROVIDENCE has subjected to his will, has a dreadful reckoning to make, when each individual shall receive from the *same measure* he has meted out to others.

Were sedentary employments intermixed with a due quantity of exercise, they would never do much hurt. It is constant confinement that ruins health. A man will not be injured by sitting at his work three or four hours at a time; but if he be *obliged*, by an *unfeeling master*, to sit eight or ten, he will soon be said to drag on life instead of enjoying it. Weak and ailing he will languish out a few miserable years, and at last sink into an untimely grave.

Weak fibres are the constant companion of *inactivity*. Nothing but daily *exercise* in the *open air* * can brace and strengthen the powers of the *stomach*, and prevent therefore an endless train of diseases, which proceed from a relaxed state of that organ. We seldom hear the active or laborious complain of what are called *nervous diseases*; these are reserved for the sons of idleness. Many have been completely cured of these disorders by being reduced, from a state of opulence, to labour for their daily bread. This plainly points out the sources from whence *nervous diseases* flow, and the means by which they may be prevented †.

Dr. CHEYNE, in his excellent Treatise on Health, says, that the weak and valetudinary ought to make EXERCISE a part of their religion. We would recommend this, not only to the weak and valetudinary, but to sedentary artificers, shopkeepers, studious persons, &c. &c. Such ought to consider *exercise* as necessary a duty as to

* The *oxygenation of the blood* has been before shewn to be one of the great reasons for the necessity of daily *exercise*, and this will be sooner and better effected the *purer the air*. Dr. BEDDOES, after breathing each day some pure OXYGEN AIR, says he felt himself not only warmer, but *certainly more disposed towards, and capable of, MUSCULAR EXERTION*. Vide his Letter to Dr. DARWIN.

† Dr. BUCHAN.

take food; and this might be usually done without any great loss of time or interruption to business.

Every man, in short, should oblige himself by some absolute rule to engage in *daily exercise*. *Indolence*, like other vices, when indulged, gains ground, and at length becomes agreeable. Hence many who were fond of *exercise* in the early part of life, become quite averse to it afterwards. Diseases are engendered destructive of the resolution of the mind. Nauseous drugs are had recourse to. The stimulus at the stomach spreads its influence for a time over the whole body. It at last loses its efficacy, or becomes prejudicial, and the *pale, flatulent, and bloated hypochondriac*, flies from physician to physician, none of whom dare advise him EXERCISE, which he is averse to, and says he cannot take, and he falls at last into diseases of a more serious aspect, and dies of spasm in the stomach, or dropsy, or asthma, or jaundice, or a cough with mucous expectoration, or palsy, or hæmoptoe, or some other disease that either arises from, or is always *engrafted* upon, a *weak and debilitated frame* *.

I shall conclude this long but *useful* essay with some beautiful lines from AKENSIDE, whose poem, entitled

* Vide BROWN's Elements.

the Art of Preserving Health, might have possibly promoted the *discoveries* of the late Dr. BROWN.

The shades descend, and midnight o'er the world
expands her sable wings. Great NATURE droops
through all her works. How happy he whose toil
has o'er his languid powerless limbs diffus'd
a *pleasing lassitude*. He not in vain
invokes the gentle deity of dreams.—

By toil subdu'd, the warrior and the hind
sleep *fast and deep*:—THEIR ACTIVE FUNCTIONS SOON
WITH GENEROUS STREAMS THE SUBTLE TUBES SUPPLY*.
Ere morn the *tonic irritable nerves*
feel the fresh impulse, and awake the soul.

* Vide Law III. *The Accumulation of Excitability.*

SECT.

SECT. VIII.

ON FOOD.

AT first, the food taken into the stomach retaining its peculiar properties, *irritates* the inner coat of that organ, and occasions a contraction of its two orifices. The food, thus confined, then undergoes a constant agitation by means of the abdominal muscles, and of the diaphragm, and by the motion of the fibres of the stomach itself. By these movements, every part of the food is exposed to the action of a fluid secreted in the stomach, called *the gastric juice*, which (as water dissolves sugar) gradually dissolves and attenuates the food (as presently will be proved *), and prepares it for its passage into, and farther change in, the intestines.

The painful sensation of *hunger*, which is the irritation of the gastric juice on the inner coat of the stomach, or the sensation of a defective supply of chyle in the arterial system †, being removed by the food, we soon feel
a mild

* Vide Sect. IX.

† Nothing better illustrates this, than what happened to Admiral BROWN, Captains CHEAT and HAMILTON, when shipwrecked on the west coast of South

a mild and undescribable delight, first from the stimulus of the aliment; and secondly, from the distension of this, and the increased action of other parts*.

If it should seem strange that *pleasure* arises from the stimulus of food on the sentient nerves of this important organ, let us recollect only the effect of a moderate dose of *opium* to those unaccustomed to that stimulus. They are commonly so transported with the pleasing sensation it induces, that they feel, as they oftentimes express themselves, as though they were in heaven, and enjoy so perfect a pleasure, that no happiness in the world can surpass the charms of this agreeable ecstasy. On the other hand, what a terrible agony will two or three grains of *crocus metallorum* throw the whole fabric into; this part being of so acute a feeling, that some philosophers have for this reason thought it to be the seat of the soul itself.

Besides this consideration, we must here take notice,

South America; who, after suffering months of hunger and fatigue, were reduced to skin and bone. A table, says BYRON, was spread out for us by the Indians, with cold ham and fowls, which only we *three* sat down to, and in a short time we dispatched more than *ten* men with common appetites would have done, and yet we complained of being *unsatisfied*. For a long while we got up two or three times in the night to cram ourselves. Captain CHEAT used to declare, that he was quite ashamed of himself.

* Vide Law II.

that

that the stomach, being distended with food, presses on *the spleen**, and thereby occasions a greater quantity of blood to pass into the *pancreas*, and consequently a greater increase of the secretion from that viscus;—and by obstructing in some degree the passage of blood in the descending trunk of the *aorta*, causes an increased flux of blood to the *head*, and hence, after a full meal, inactivity and drowsiness†, and sometimes apoplexy‡, ensue; and hence also proceed those flushings or redness in the face, so conspicuous in weak and exhausted persons.

The increased *oxygenation of the blood* from the same circumstance has been before noticed, when on the subject of ANIMAL HEAT, and *the balance*, that is constantly found to take place, betwixt the *hydrogen* received in the stomach, and the *oxygen air* drawn into the blood

* The true office of the *SPLEEN* was the happy discovery of the ingenious Dr. HAIGHTON, Lecturer on Physiology to the Pupils of Guy's and St. Thomas's Hospitals. It did not escape the penetrating mind of the Reverend Mr. TOWNSEND, and this coincidence of thought is a further proof of its truth. See *the Guide to Health*, page 33. Vide note †, page 215.

† Mr. BRINDLEY, the famous canal engineer, mentioned to Dr. DARWIN that he had more than once seen the experiment of a man extending himself across the large stone of a corn-mill, and that by gradually letting the stone whirl, the man fell fast asleep. Dr. DARWIN.

‡ See *the Guide to Health*.

F f

while.

while passing through the lungs. Probably, from this cause it was, that more of Sir JOSEPH BANKS and Dr. SOLANDER's party did not perish at *Terra Del Fuego* *. Hence the importance of the consideration of food † in all-inflammatory states of the body. And hence the consideration of a peculiar diet for the removal of many disorders incident to the human frame.

We will now attempt to trace the food in its digested form, after it is thrown out from the stomach into the *intestines*.

The aliment having remained during two or more hours in the stomach is converted, first, into a greyish

* They had with them a bottle of rum, and a sailor, who was seized as bad as the black, recovered from *his torpor* by drinking of the rum. Vide *Cook's Voyages*. See also the Section on *Animal Heat*, page 81.

† Mr. SUTTON, in the vicinity of Plymouth, inoculated a lady, who on the third day after the commencement of the irruptive fever, had five or six red pimples, which formed gradually into pustules.

During the progress of the disease, as she sat at table, she expressed uneasiness, and wished to have stronger evidence, than yet appeared, that she had the small-pox. Mr. Sutton told her, that she had only to eat a portion of hare, which was on the table, and drink one glass of wine, and she would have sufficient evidence to satisfy her mind.

She accepted the proposal; the fever increased; and the small-pox, from being *discrete*, became *confluent*.

Mr. Sutton then took fright, and delivered her to the care of Drs. Mudge and Huxham, by whose watchful attention she was carried safely through the secondary fever. Vide *the Guide to Health*, page 156.

pulp,

pulp, which is usually called *chyme*. This *chyme*, of fluid, passes out of the *pylorus*, or right orifice of the stomach, the fibres of which relax to afford it a passage; while the grosser and less altered particles remain in the *living retort*, to adopt the expression of the Reverend Mr. TOWNSEND, till they acquire a sufficient fluidity to pass into the intestinal canal. As the digested food enters the *duodenum* *, it stimulates the common duct of the gall bladder and the liver, and from a law in the animal œconomy, which has given the highest sensibility to the nerves at the mouths of the several ducts, which, by a sympathetic communication, occasions their several glands either to secrete or pour out a greater quantity of fluid, the *chyme* receives a full supply of *bile*, and of *saliva*, secreted from the *pancreas* †; it also intermingles with *mucus* from innumerable exhalent arteries, which still farther animalizes the *chyme*.

● The commencement of the intestines.

† The *pancreas* is a large gland, which lies near the stomach, and discharges, by a short duct, into the intestines, a liquor, which it separates from the blood. It is difficult to collect any quantity of this juice, because it is not lodged in any particular receptacle, but flows from the gland into the intestines, near the upper orifice of the stomach. However, in dogs this has been executed by tying a bottle near the duct of the gland, while the animal was living, by which a quantity of the juice has been collected, and found in appearance to resemble the *saliva*.

The *intestinal canal* is five or six times as long as the body, and forms many circumvolutions in the cavity of the abdomen, which it traverses from right to left, and again from left to right. The inner coat of the intestines, by being more capacious than their exterior tunics, occasions a multitude of *plaits* *, at certain regular distances from each other, and these become less and less, and at farther intervals, as they descend. This disposition will be found to afford a still farther proof of that divine wisdom, which the anatomist and physiologist cannot fail to observe in all their pursuits; for if the intestinal canal was much shorter than it is; and if its inner surface was smooth and destitute of plaits; the aliment would consequently pass with great rapidity to its termination, and sufficient time would be wanting to assimilate the chyme, and for the necessary absorption of it by the numerous *villi*, or hair-like projections †, which terminate in *lacteals*: so that the body, unless constantly replenished, would be deprived of the supply of nutrition, which is so essential to life and health:—but the length and circumvolutions of the intestines, the inequality of their internal surface, and the course of the

* Called by anatomists *valvulae conniventes*.

† Vide the Section on *Animal Heat*, and note *, page 87.

aliment through them, all concur to perfect the separation of the chyle from the fæces, and to afford the necessary nourishment * to the body.

* Mr. BELCHER happening to dine at a callico printer's, was surprised to find the bones of the pork at table of a very red appearance. They had eat *madder*. This eminent surgeon mixed that substance with different foods, and gave it to fowls, and other animals, and a similar change of colour in all the bones, and even in the teeth, took place: but, after a certain time, if these were fed on food containing no *madder*, the bones *regained* their natural appearance. To prove that the different parts of the body are renewed, JOHN HUNTER fed two ducks, the one with *barley*, the other with *sprats*, for about a month, and killed both at the same time. When they were dressed and served at his table, that fed wholly with *sprats* was *hardly eatable*, *it tasted so strongly of fish*. These facts prove, that our fabric is ever being pulled to pieces and renewed; that the matter is continually changed, though the same *identity* remains! They also prove that our body may be composed of parts *unassimilated*, though *changed* by the wonder-working powers of the body from *inanimate to animate matter*!

SECT.

SECT. IX.

OF THE GASTRIC SOLVENT,

AND

THE RELATIVE DIGESTIBILITY OF FOOD.

IN serpents, some birds, and several kinds of fish, which swallow whole animals, and retain them long in their stomach, *digestion* seems to be performed, says CHESELDEN, by *some unknown menstruum*; for we frequently find in their stomachs animals so totally digested, *before their form is destroyed*, that their very bones are made *soft*. One may indeed draw very plausible inferences concerning human digestion, from observation on other species of animals, especially from birds of prey, the cat and dog, which resemble us so much in the structure of the stomach. But analogical arguments are *probable* indeed, but not *conclusive*. And it is an object of much higher importance to attain *certainity* in man than in animals. In the writings of ancient and modern physicians no topic is more frequently discussed, yet there is little else beside *supposition*: direct experiments
upon

upon *man* are entirely wanting, and their researches are illuminated only by the *twilight* of conjecture, and supported by *precarious hypothesis*. Upon reflection, says the celebrated SPALLANZANI, it appeared that direct experiments might be made on man, and for this purpose it was necessary to swallow tubes full of various vegetable and animal substances, in order clearly to ascertain *the changes* they undergo in the stomach. I will candidly own, says he, that this experiment gave me at first some apprehension. The histories of indigestible substances occasioning troublesome symptoms, and being vomited up after a considerable time *, occurred to my imagination. I also recollected instances where such bodies had stopped in the alimentary canal †. Other facts however, where the result was contrary, and of more frequent occurrence, gave me also some confidence. Thus we

* Vide Baron HALLER, T. 6.

† Dr. COE, in his Treatise on Biliary Concretions, gives an instance of a woman, from whose rectum was extracted a concretion, the nucleus of which was a *plum-stone*. In the Edinburgh Medical Essays, we have an account of a similar fact. In the Essays and Observations, Physical and Literary, there is the history of a boy who had three stones extracted from the rectum, the nuclei of which were the small bones of *sheep's trotters*. In the Philosophical Transactions, we have an account of a concretion formed upon a *plum-stone*, and retained in the blind gut: and in the London Medical Journal, Mr. JOHNSON relates the case of a woman, who passed a ball of hardened feces, weighing three quarters of an ounce, the nucleus of which was a *plum-stone*.

every

every day see the stones of cherries, medlars, plums, &c. swallowed and voided with impunity. This consideration at last determined me to make the trial with as great caution as possible.

I swallowed, in the morning fasting, a linen bag, containing 52 grains of *masticated bread*. I retained the purse 23 hours without experiencing the smallest inconvenience, and then voided it quite *empty*. The string used for sewing and tying it was entire, nor was there any rent in the bag itself. The fortunate result of this experiment gave me great encouragement to undertake others.

From *vegetable* I proceeded to *animal* substances. In a similar bag 60 grains of *boiled veal* were enclosed, previously masticated. The purse was voided in 18 hours and three quarters, and the flesh was *consumed*. Only a few fibres remained, and these were void of succulency, as if they had been set under a press.

My next experiments were made to see, whether digestion was accomplished or aided by a *tritulating power* in the stomach.

BOERHAAVE, neither satisfied with the system of digestion in the human stomach by heat, as suggested by *Galen*, and adopted by his followers; nor yet better pleased

pleased with attributing this process to the vital energy of the soul residing in the stomach, as conceived by the fertile imagination of *Van Helmont*; invented a system of his own, in which he attributes the digestion of our food partly to *fermentation*, but principally to *trituration*, *pressure*, and *powerful quassation*. He describes the folds of the stomach as grinding the more solid parts of the aliment; and, to assist in this process, he calls in the aid of its external coat, with the diaphragm, and the numerous muscles of the abdomen. Not satisfied with these, he takes into his account the violent pulsations of the subjacent aorta, with the vibrations of innumerable surrounding arteries, which he estimates at no less than three thousand six hundred pulsations in the hour.

This distinguished physician reasoned from analogy, and took particular notice of the *ostrich*, which he had observed to swallow pieces of iron and of glass, evidently for the purpose of trituration, because the sound of *grinding* was perceptible to those who listened.

In the *granivorous birds* he had remarked, beside the crop, furnished with salivary glands to mollify their food, a gizzard, or second stomach, provided with strong mus-

G g

cles

cles to *triturate* the grain; and the avidity with which they swallow gravel to assist the operation had not escaped his notice. Having examined the structure of the *lobster*, he saw at the mouth of the stomach a curious mechanism, *three teeth*, of which *one*, moved by a strong muscle, *tritirates* the food against the *other two*.

In the larger *crawfish* of the sea, he might have noticed a structure somewhat different, where to answer the same intentions, instead of *three teeth*, we observe a *pestle* supplied with a strong muscle and placed between *two mortars*.

No wonder, then, that this great mechanic on the subject of digestion had mechanical ideas.

To prove that digestion in the human stomach is not aided by triture, I was under the necessity, says SPALLANZANI, of swallowing thin tubes. These tubes were voided in about 22 hours. Among the tubes employed in these experiments I procured some to be made so *thin* that the slightest pressure would have crushed them to pieces, or have bent in their *edges*; but though I frequently used them, *not one was ever broken*, nor on examination could I perceive the *smallest fissure*.

Having thus established this fundamental proposition, viz. THAT DIGESTION IS PRODUCED BY THE GASTRIC FLUID INDEPENDENTLY OF TRITURATION, I had before me, says he, a fine field for experiments, which could not fail to suggest some important truths.

The necessity of mastication deserves to be well known. There is, perhaps, no person who has not some time or other been subject to indigestion for want of having chewed sufficiently his food. I took *two* pieces from a pigeon's heart, each weighing *forty-five* grains, and having *chewed one* as much as I used to chew my food, enclosed them in two spheres, and swallowed them at the same time. Both these tubes happened to be voided at the same time, and I then saw *how much digestion is promoted by mastication*. Of the *masticated flesh* there remained only *4 grains*, whereas of *the other* there were *18 left*. This was confirmed by two other experiments, one made with *mutton*, the other with *veal*. The reason of this is obvious. Not to mention the saliva which moistens and attenuates the food, it cannot be doubted, that when it is reduced to pieces by the action of the teeth, the *gastric juice* meets it at all points, and therefore the more speedily dissolves it, just as other menstrea

dissolve soonest those bodies that have been previously broken into fragments*.

I now wished to make some experiments with the gastric fluid *out of the body*. A sufficient quantity could not be obtained by killing birds and other animals, and it became necessary to invent a contrivance for obtaining it from them alive. Three tubes containing *sponge* were therefore introduced into the stomach of a crow, and after four hours these were vomited up. The pieces of sponge being saturated with the fluids of that cavity, were then taken out and pressed between the fingers. These afforded 37 grains of *gastric liquor* of a transparent yellow colour, possessing a somewhat bitter and saltish taste.

I now attempted, says the ABBÉ, to produce *artificial digestion* with the gastric juice thus obtained.

It was January, and Fahrenheit's thermometer, placed near the vessel used for the experiment, stood at 42 and 43 degrees. For greater certainty in these experiments, I established a term of comparison, by employing similar vessels, containing the same flesh, infused in water. I also took care, upon the present occasion, that the flesh

* Vide what has been said page 219.

should

should be completely immersed in their respective liquors, and that the phials should be closed with stopples. *For seven days the flesh kept in the gastric juice, and in water continued the same.* On the eighth I perceived, says SPALLANZANI, a slight solution, for upon agitating both liquors, several particles separated from the larger mass, and fell down to the bottom of the phials. No further progress was afterwards made, and the gastric fluid did not seem at all more efficacious than common water; only the flesh immersed in the former *in a surprising manner was preserved from PUTREFACTION.* In this experiment I had used beef; I verified the same observation upon the more tender flesh of calves, chickens, and pigeons; the temperature of air was about 48 degrees of Fahrenheit's thermometer. — While I was making these experiments in the natural temperature of the air, I was employed about others of a like nature in a warmer medium, viz. in a stove, in which the heat varied from 79 degrees to 80 of heat. *And now the effects produced by the gastric fluid, greatly differed from those produced by water.* In the latter the flesh began to be a little dissolved in two days; this was the effect of incipient putrefaction from heat and moisture *. The

* Vide page 151, line 11.

fætid smell continued to increase during the following day, and in a week became intolerable, when the flesh was reduced to a nauseous pulp. *In the gastric juice the solution was more rapid, and exhibited very different phænomena; twenty-five hours were sufficient to decompose the flesh contained in it, and in a little more than two days there remained only a very small morsel entire.* These solutions never emitted any *bad smell*; whence it is evident, that they did not arise from incipient putrefaction, like those in water, but from a more efficacious and a different menstruum, viz. the GASTRIC LIQUOR*.

To Edinburgh there came by accident a hussar, a man of weak understanding, who gained a miserable livelihood by swallowing pebble-stones, and chewing flints †, for the amusement of the common people. The stomach of the *stone-eater*, as he chose to style himself, was so much distended, that he was able to swallow a

* This is a very important experiment, and confirms what has been before said, when treating on ANIMAL HEAT, and the balance betwixt DIGESTION and the OXYGENATION OF THE BLOOD. Vide p. 91.

† His front teeth were *filed down*, and he had the art of splitting into pieces *flint stones*, by striking them with his fore-teeth in a *particular direction*, just as they fashion *flints* for guns. *These pieces* he would shew to his astonished visitants, put them under his tongue, and pretending to have swallowed them, he would then proceed actually to gulp down some *smooth pebble-stones*, which he took care to have by him on the table.

great number of pebble-stones during the day; and these might be plainly felt, and be *chinked*, if you pressed forcibly with your hand below the short ribs on the left side.

Dr. STEVENS tried many experiments, similar to those above related, with this man, who swallowed silver spheres, which were perforated so fine as hardly to admit a needle into each opening, and he always found the food that he enclosed in these bodies dissolved. He next turned his attention to the different degrees of *solubility*; or, as it was formerly called, to the *hard* or *easy digestion* of *different substances*, and the result of his experiments are equally curious as important.

Having procured a whelp five months old, it was kept fasting sixteen hours, and four of the globes, as used in the foregoing experiments, each containing a like quantity of food, were forced into its stomach. The substances had been previously cooked, and weighed each 16 grains. Seven hours afterwards the animal was killed, and the globes were taken out of the stomach; when the *beef* was found to have lost $10\frac{1}{2}$ grains, the *mutton* 6 grains, the *potato* 5 grains, the *fowl* 4 grains, and the *parsnep* 0.

To

To another dog that had fasted twelve hours I gave, says he, 16 grains of *roasted beef*, in a second sphere the same quantity of *veal*, in a third only *fat*, and in a fourth *wheaten bread*. In ten hours the animal was killed and opened, and the tubes were taken out of its stomach. The *beef* and *bread* were quite dissolved; the *veal* had lost only 10 grains, and the *fat* $8\frac{1}{2}$ grains.

As in the last experiment the *veal* was not so soon dissolved as the *beef*, I began, says he, to suspect that the flesh of *young animals* in general is less easy to digest than *that of old ones*. I therefore took care to repeat the experiment with *lamb* and *mutton*, which were put in equal quantities into two tubes. The result was as before. In seven hours the *mutton* was quite dissolved, whereas the *lamb* had lost only 10 grains.

Having kept a dog fasting eighteen hours, that his stomach might be free from the remains of food, I killed it, and collected about half an ounce of pure gastric fluid, which was put into separate phials. I then made trial of *mutton*, *veal*, *lamb*, *chicken*, and other *animal* and *vegetable substances*, and imitating the heat of the stomach, they were all readily dissolved; but the time requisite for the completion of this process was different,
and

and answered exactly to the results of the preceding experiments*.

The *husk* of the seeds of plants appears to be indigestible in its natural state; whether this arises, says the celebrated JOHN HUNTER, from the *nature of the husk* itself, or from its *compactness* †, I am not certain, but am inclined to *suppose the last*; as we find the *cocoa*, which is only a husk, to be digestible, when ground to a powder and well boiled. We know, likewise, that cuticle, horn, and bone, although animal substances, are not affected, in the first instance, by the gastric juice; yet if reduced in PAPIN's digester ‡ to a jelly, that

* We are apt to imagine, that *hard* substances are more difficultly dissolved than *soft*, but a little attention shews us that *the menstruum* being adapted to the subject, *hardness has nothing to do in it*: OIL OF VITRIOL dissolves *steel*, and yet does not touch *wax*, and OIL dissolves *wax*, and does not touch *iron*; and so in a thousand instances. Nurses call *lamb* harmless only from the nature of the animal. Dr. SNEBBEARE.

† This doubt, the author of the present work would have answered himself by experiment, but having felt the tortures of pain, he could not bear to inflict death on any animal incapable of doing him an injury from its nature, unless where the importance of the subject had justified, or rather had demanded, the cruelty.

‡ The advantage of PAPIN's digester is to give *boiling water* a greater heat than it is capable of naturally having. To do this, the vapour must not be suffered to escape. The lid is so contrived as to open inwards, that the steam may not force its way out. There is a stopple, however, on the lid,

that jelly can be acted upon in the stomach; we must therefore suppose that a certain natural degree of solidity in animal and vegetable substances render them indigestible. This compactness in the husk seems to be intended to preserve, while under ground, the farinaceous part of the seed, in which the living principle is placed; the husk having probably no other power of resisting putrefaction than what arises from its texture. Of twenty-five ripe grapes, which SPALANZANI swallowed, by way of experiment, eighteen were voided *entire*, of the other seven the *skins* only appeared. He made the same experiments with cherries, and currants; as well ripe as unripe, and by far the greater number were voided *entire*. Although most husks are not capable of being dissolved in the gastric juice, they generally allow of transudation; and that the seed is in some degree affected, is known by its swelling in the stomach; yet it can only admit by that means a certain portion of the

to which is fixed the arm of a lever, suspended on a balance. Weights are applied at the end nearest the stopple. Now when the water within is so very much heated, that the steam *will* force open the stopple, and so raise up the arm of the lever, by knowing what weight is suspended, we can determine exactly the degree of heat. Vide what was before said on the cooling effects of *evaporation*, or the quantity of *caloric* that escapes when water is *aerIALIZED* or converted into *steam*, page 103.

gastric

gastric juice, and that not sufficient to convert it into chyle; therefore we see grain when swallowed whole, unless in birds, whose gizzards serve them as our teeth, to grind or divide the grain, pass entire, though much swelled; and even the kernels of some nuts, as *Spanish chesnuts*, are not digestible when eat raw.

But not only *very compact substances* are difficult of digestion, but also those that are *fluid* are so likewise: and we may observe, that nature has given us very few fluids as articles of food, and to render the few fitter for the digestive powers, a *coagulating principle* is provided to give them some degree of solidity*.

The LUNGS being designed as the organ for *the oxygenation of the blood*, nature has wisely ordained, *that we shall not oxygenate the blood by the stomach, unless it be in those climates, where we are oppressed by excessive heat*; hence in cold climates the evil effects of nitre, of acids, even of punch †, and of what is called a cooling diet:
and

* All milk turns in the stomach into curds and whey. The property of calves *rennet* is well known. When too much *acidity* prevails in the stomach, a little *magnesia* corrects it, and prevents the curd from being *too hard*, and consequently difficult of digestion. It is often proper to dilute milk, in order that the *coagula* may be broken into very small fragments.

† By eating an exotic fruit, says Dr. BROWN, which had a mixture of the qualities of the *water-melon*, the *orange* and *lime*, in a quarter of an hour

and hence the necessity of condiments when using such weak and unwholesome food.

I had an attack in my stomach in the middle of my lecture. By means of a cordial stimulus I repelled it, and went on very well with my lecture.—At other times I have prevented such an effect, by anticipating the remedy.—This doctrine puts much in our power: but we should not therefore play tricks with it. On the contrary, we have great reason, says he, to be thankful for the command it gives us over our health, and that also, by the use of means not inelegant, nauseous, and clumsy; but quite the contrary.

One gentleman excepted, says Dr. SHEBBEARE, and I never saw a gentleman or lady who wholly abstained from animal food look like other people; nothing is so easy to distinguish as a *vegetable man*, by his physiognomy, the fittest appellation by which they can be distinguished; he neither looks, talks, or moves like other people; his face conveys a declaration of his whole body being out of order, by the lifeless insipidity which is in it, as his conversation does of his mind being disturbed, his whole time being taken up in recounting to the world his manner of living, his feelings, his weak stomach, his disturbed sleep, his watchings, how he fences out the cold air, what shoes and waistcoats he has on, and every other ridiculous particularity of his whole life; if he pretends to have spirits, it is no more than a certain equability of a lifeless inanimate state, like that of the *dormouse* amongst animals, or the *yew-tree* in winter amongst vegetables; the warmth of the one, and the green of the other, just shew they are alive, with this difference however, that the summer will wake the two latter into actual life and motion; whereas, to the man of vegetables, the summer never comes, that comes to all; and the very power of vegetation and recovery from sleep, which is bestowed on the plant and dormouse, are forbidden him by the regimen he pursues.

SECT.

SECT. X.

PRACTICAL OBSERVATIONS.

IN page 140, when treating of *temperaments*, we remarked that the muscular fibres of the body, at different periods of life, possessed different degrees of excitability.

This will lead us to consider the aliment proper for the different stages of life.

I. OF THE FOOD PROPER FOR CHILDREN.

Nature not only points out the food fit for infancy, but also kindly prepares it. When the babe, soon after it is born in this *cold* world, is applied to its mother's bosom, its sense of perceiving *warmth* is first agreeably affected; next its sense of *smell** is delighted with the

* Any one may observe this, when very young infants are about to suck; for at those early periods of life, the perfume of the milk affects the organ of smell, much more powerfully, than after the repeated habits of smelling has inured it to odours of common strength, and the lacrymal sack empties itself into the nostrils, and an increase of tears is poured into the eyes. And in our adult years, the stronger smells, though they are at the same time agreeable to us, as of volatile spirits, continue to produce an increased secretion of tears.
Dr. DARWIN.

A calf discovers its mother by its sense of smell, and each pig has its peculiar teat to which it always goes. What is very remarkable, when a lamb dies, to make the ewe take to another lamb, it must be covered for a few days with the fleece of the dead one.

odour of the milk; then its *taste* is gratified by the flavour of it; afterwards the appetites of *hunger* and of *thirst* afford pleasure by the possession of their objects, and by the subsequent digestion of the aliment; and lastly, the sense of *touch* is delighted by the softness and smoothness of the milky fountain, which the innocent embraces with its hands, presses with its lips, and watches with its eyes. Satisfied, it smiles at the enjoyment of such a variety of pleasures. It feels an animal attraction, which is love; a sensation, when the object is present, a desire, when it is absent; which constitutes the purest source of human felicity, the cordial drop in the otherwise vapid cup of life, and which overpays the fond mother for all her solitudes and care.

It appears from the annual registers of the dead, that almost one half of the children born in Great Britain of great families die in their infancy. To many, indeed, this may appear a natural evil; but on due examination, it will be found to be one of our own creating. Were the deaths of infants a natural evil, other animals would be as liable to die young as man, but this we find is by no means the case.

A mother who abandons the fruit of her womb, as soon as it is born, to the sole care of a hireling, hardly
deserves

deserves that tender appellation. Nothing can be so preposterous than a mother who thinks it below her to take care of her own child. If we search nature throughout, we cannot find a parallel to this. Every other animal is the nurse of its own offspring, and they thrive accordingly. Were the brutes to bring up their young by *proxy*, they would share the same fate with those of the human species*.

CONNUBIAL FAIR ! whom no fond transport warms
to lull your infant in maternal arms ;
who, blest'd in vain with tumid bosom, hear
his tender wailing with unfeeling ear ;
the soothing kifs and milky rill deny
to the sweet pouting lip, and glistening eye !—
Ah ! what avails the cradle's damask roof,
the eider bolster, and embroider'd woof !—
Oft hears the gilded coach, unpity'd plains,
and many a tear the tassell'd cushion stains !
No voice so sweet attunes *his* cares to rest,
so soft no pillow, as his *mother's* breast !—

Dr. DARWIN.

A child, soon after the birth, shews an inclination to suck ; and there is no reason why it should not be gratified. It is true, the mother's milk does not always come immediately after the birth ; but this is the way to

* This general rule admits of but *few* exceptions.

bring

bring it*: besides, the *first milk* that the child can squeeze out of the breast answers the purpose of *cleansing*, better than all the drugs in the apothecary's shop, and at the same time prevents inflammations of the breast, fevers, and other dangerous diseases, from the suppression of this natural secretion. It is strange how people came to think that the first thing given to a child should be *drugs*. This is beginning with medicine by times, and no wonder that they generally end with it. It sometimes happens, indeed, that a child does not discharge the *meconium* so soon as might be wished; this has induced physicians, in such cases, to give something of an opening nature to cleanse the first passages. Mid-

* Dr. ARMSTRONG, Physician to the British Lying-in Hospital, in this particular, seconds the advice given to mothers by the benevolent Dr. BUCHAN. An infant, says he, although for some time it has no great need for food; yet doubtless ought to be laid to the breast, as soon as the mother may, by sleep, or otherwise, be sufficiently refreshed to undergo the little fatigue that an attempt to suckle may occasion. This method, however unusual with some, is most agreeable to nature. By means of putting the child *early* to the breast, especially the first time of suckling, the nipple will be formed, and the milk gradually brought on. Hence much pain, and its consequences, will be prevented, as well as the frequency of sore nipples, which, in a first lying-in, have been wont to occasion no small inconvenience. To teach the child how to suck, a little milk and water, sweetened with white sugar, may be given it at the end of a tea-spoon, which the innocent will clasp in its mouth; or a finger wetted with it may be frequently put between its gums.

Wives

wives have improved upon this hint, and never fail to give syrups, oils, &c. &c. whether they be necessary or not. Cramming an infant with such *indigestible stuff*, as soon as it is born, can hardly fail to make it sick, and bring on a real occasion for medicines.

Almost as soon as the babe is born the *officious nurse*, knowing what is comfortable to herself, imagines that what is good for her, and her mistress, cannot be bad for the poor infant. This naturally suggests the idea of cordials. Accordingly wine is universally mixed by nurses with the first food of children, or DALBY'S Carminative is administered. Nothing can be more fallacious, than this mode of reasoning, or more hurtful than the conduct founded on it. Children need very little food for some time after their birth; and what they receive should be light and of a cooling quality. A small quantity of WINE hurries on the *respiration*, and consequently the *circulation*, which nature for wise purposes has made already very *rapid* *.

If the mother or nurse has enough of *milk*, the child will need no other food. Milk itself is produced from

* In a *new-born infant* the pulse is about 134 in a minute, in *middle age* from 60 to 80, and in *extreme old age* from 50 to 24. DR. ADAIR.

food taken in by the mother. It is in her stomach that the aliment is dissolved, or digested, which by a combination of powers in the *chylopoietic viscera*, or parts preparing the chyle, is so far animalized * as to be converted into a kind of white blood. Hence it is very apparent, that previous to an infant having acquired strength enough to convert solid food into bland and wholesome chyle, and while the fibres of the stomach and intestines are peculiarly *irritable*, the parent, by a wise substitution in nature, has previously accomplished this work for the infant she is about to nourish.

After the third or fourth month, it may then be proper to give the child, once or twice a day, a little of some other food †. This will ease the mother, will accustom the child by degrees to take food, and will render after

* We may observe the hen hunting after *worms* and *little insects* for its young; and poulterers follow without the bias of theory the same method of rearing them. REAUMUR gave two ducks, the one *animal*, and the other *vegetable* food, and having killed them, he found the animal substances *always* sooner digested than the grain. Thus then it seems, that ANIMAL FOOD is much easier digested and transmuted in children into *animal substance*, by the powers of digestion, than the vegetable; and this plainly appears, if you begin from the first moment of the fetus increasing in the womb, where, till its coming into light, it is formed entirely of animal substance.

† As *soft biscuit* or *crust of bread* (which are easier digested than *crumb*) with *milk* and *water*.

weaning both less difficult and less dangerous. Nature abhors all sudden transitions. For this purpose, the food of children ought not only to be simple, but to resemble, as nearly as possible, the properties of milk. Indeed *milk* should make a principal part of their food, not only before they are weaned, but for a long time after.

Bread may be given to a child as soon as it shews an inclination to chew. The very chewing of bread will promote the cutting of the teeth, and the discharge of saliva. Children discover an early inclination to chew whatever is put into their hands. Parents observe the *inclination*, but know not how to apply the *remedy*. Instead of giving to the child something which may at once exercise its gums and afford it nourishment, they commonly put into its hands a piece of hard metal, or impenetrable coral. A crust of bread, or a piece of stick liquorice, is the best SUCK-THUMB. It not only answers the purpose better than any thing else, but has the additional properties of nourishing the child, and carrying the saliva down the stomach, which is a great promoter of digestion.

It is soon enough to allow children *animal food*, when they have got teeth to tear it. Then we should remem-

ber that their pulse is usually at 130, and from the observation of Mr. TOWNSEND and others, the pulse is quickened by *animal food*, and the same is not observed, when we have been eating only *vegetables* *. We should therefore employ a due mixture of vegetable with their animal food, which, as the proper food of manhood, the formation of his *teeth* † naturally points out to the physiologists, and the experience of ages has proved to be the most conducive to health ‡. As the stomachs of children cannot bear repletion, because of their temperament, and as they require food not only to keep up the parts already formed, but also to make an addition to them, they ought therefore to have *slender*, but *frequent* meals, and this in proportion to their tender age.

* Vide the *Guide to Health*, page 27.

† He has the *canine* or tearing teeth, the *incisors* or clippers, and the *grinders*. Those animals that have *only* the *canine teeth*, as the lion, &c. have a *gastric juice* that does not dissolve *vegetables*; and on the reverse, those that have *only* the *incisors* and *grinders*, as the horse, &c. have a *gastric juice* that *only* dissolves *vegetable substances*.

‡ *Poverty*, says the celebrated ADAM SMITH, though it no doubt discourages, does not always prevent marriage. It seems even to be *favourable* to *generation*. A half-starved highland woman, frequently bears more than *twenty children*, while a pampered fine lady is incapable of bearing any, and is generally exhausted by two or three. But *poverty*, though it quickens the powers of generation, is also extremely *unfavourable* to the rearing of children. *The tender plant is produced in so cold a soil, that it soon withers and dies. It is not uncommon in the highlands of Scotland, for a mother who has borne TWENTY children to have but TWO alive.*

2. OF THE FOOD PROPER FOR MANHOOD.

It is an ancient and approved maxim, that a life guided entirely according to the directions of art, must be a miserable one, and the most judicious practitioners, sensible of the justness of the observation, and that what is prohibited is often the more eagerly coveted, have endeavoured, even to persons labouring under disease, to give as great latitude as possible in the articles of diet, and to reconcile every part of the regimen they prescribe, as nearly, as they can, to the common mode of living, in order that the patient may be reminded as little as possible of his misfortune *. Our directions therefore shall not be frivolously minute, but as short as possible on this subject.

In the first place we ought carefully to *chew* our food, otherwise we shall impose much unnecessary labour on the stomach, and retard digestion.

With respect to *quantity*, it is evident that this must be regulated by our feelings. A healthy man cannot be

* Vide page 223.

said to exceed in the quantity of his meal, if he finishes it with a relish for more ; if, immediately after eating, he can, if required, follow any employment, that does not demand strong exercise or violent exertions ; which to persons in easy circumstances will rarely be necessary, and ought in general to be avoided, as it disturbs digestion * ; though daily practised from necessity, by the labouring poor †.

Gluttony is so ungentlemanly a vice, that it would be an affront to suppose that persons of polished manners, who are the persons who will probably read this book, could be capable of it. I shall therefore forbear to mention the innumerable train of evils that in time is certain to attend this beastly practice.

With respect to the *proper times* for eating, first,

* Dr. ADAIR.

† This has been before *seriously* adverted to in page 207, and it is hoped will finally have its *due weight*, the conduct of masters being here (like the traffic in human flesh) both *cruel* and *impolitic*. Dr. HARWOOD, the Professor of Anatomy at *Cambridge*, took two pointers equally hungry, and equally well fed ; the *one* he suffered to lie *quiet* after his meal, the *other* he kept for above two hours in *constant exercise*. On returning home he had them both killed. *In the stomach of the dog that was quiet and asleep, all the food was digested ; but in the stomach of the other dog that process was scarcely begun.*

OF

OF BREAKFAST.

As our ancestors breakfasted early, they dined also early, and had at least two meals after this, as appears from the allowance appointed for a *Lady Lucy*, who seems to have been one of the maids of honour in the court of HENRY the VIIIth. I may be allowed to mention their articles of food, as a matter of curiosity, to shew in what manner the *fine ladies* lived in those days.

This lady was allowed for BREAKFAST,

{ a chine of beef,
a loaf, and
a gallon of ale.

We have an account also of the BREAKFAST of an earl and countess in the lent season, viz.

{ a loaf of bread,
2 manchettes (which seems to have been loaves
of a coarser bread),
a quart of beer,
a quart of wine,
2 pieces of salt fish,
6 baconed herrings,
4 white herrings, and
a dish of sprats.

With

With respect to the *quality* of our different meals, we seem to depart more from the custom of our hardy ancestors with regard to *breakfast*, than any other meal. The contrast at first sight appears truly ridiculous. *A maid of honour*, in the court of Queen ELIZABETH, breakfasted upon *beef*, and drank *ale* after it; whilst the *sportsman*, and even the *day-labourer*, now breakfast upon *tea*.

The philosopher here humbly attempts to vindicate the present race; he believes that *sleep*, which hereafter will be fully considered *, *accumulates* the irritability of the fibre, disposing it to be more readily affected by stimuli of all kinds, hence the violent effects of all cordials taken in the morning, and hence perhaps the propriety of the gently stimulating power of coffee or bohea tea †. He would also recommend here *bread* moulded into such shapes as to produce a great deal of *crust* ‡, and he

* Vide Law III. on the Accumulation of Excitability.

† TEA, whether *green* or *bohea*, is the produce of the *same* plant, the *green tea* being the shoots and earlier leaves, and *bohea* those more *advanced* and *expanded*. Like other stimuli *green tea* made very strong is an *emetic*, or occasions *tremors*; if moderately strong it *agreeably refreshes* after a fatiguing journey, and from its excitement is productive of *wakefulness* to habits unaccustomed to *that stimulus*. GREEN TEA is suited *only* to *old age*, and *cold irritable habits*.

‡ We saw before that *solid substances* are easier acted upon than *glutinous*.

Thus

he would recal the reader, who reckons health as the first blessing, and as the means of enjoying and heightening all other blessings to reflect on the utility of the *saliva*, and to remember that bread when buttered absorbs little or no saliva, while a pound of dry bread carries down with it the same weight of this necessary moisture *. We would here, therefore, only caution the reader against taking his tea *too hot*, and if he has been engaged throughout the preceding day, or that morning, in much exercise, to join with this necessary meal one or two soft *boiled eggs* †.

Thus *hot water* sooner dissolves *white sugar* than *soft gum*, and *aqua fortis* corrodes copper, though it does not touch *wax*. It is less subject to *acrescency*, and does not *swell* in the stomach.

* Pieces of meat, that may happen to get between the teeth, are *dissolved* by this menstruum, or at any rate are so *softened*, and *their texture broken*, that this inconvenience is speedily removed. If not a fluid, possessing properties the same as the *gastric fluid*, it must be allowed, certainly, that it *greatly aids that solvent*. Vide page 222. If this penance be too great for the middle period of life, and muffins and crumpets soaking in butter must be indulged in, *children*, however, may be prohibited *butter*, and be made to have *good constitutions*, by which the contagion of *bad example* will afterwards be less severely felt.*

† This custom universally prevails in IRELAND, and is better than *hung-beef* and *anchovies*, which accompany the SCOTCH breakfast.

OF DINNER.

The *same lady* who had *so solid a breakfast*, had for
DINNER,

{ a piece of boiled beef,
a slice of roasted meat, and
a gallon of ale.

IN THE AFTERNOON,

{ a manchette, and
half a gallon of ale.

FOR SUPPER,

{ a mess of porridge,
a piece of mutton,
a cheat (or finer loaf),
and a gallon of ale.

To be sociable after supper, there was left on table,

{ a manchette loaf,
a gallon of ale, and
half a gallon of wine.

This lady had therefore four **HEAVY meals**. Instead of this we are led to recommend the modern practice of late dinners.—But because long fasting is injurious, and when very hungry we may be induced to eat more at this principal meal than can be properly digested, we would recommend *cold meats* or *soups* by way of **COLLATION**.

For

For dinner we would advise to those, who have a due sense of the importance of health, to keep as much as possible to *one dish*. To prefer MUTTON* to lamb, lamb to chicken or veal, and BEEF, if tender, to either of the *three* last, and as *fish* is soon digested, to unite some flesh meat with it, and to add to these *vegetables*. Could I believe I should be listened to with indulgence, and not incur the general censure of prejudice, having nothing but *philanthropy* and *the improvement of science* for my object, I would condemn, for convalescent and weak persons, those heterogeneous combinations called *puddings*†, and am inclined to condemn also, though not the fruit, yet the *crust* of *all pies*. Let my readers here call to mind, that eggs and milk are both reckoned wholesome *separate*, but when combined, form a compound suited only for *strong stomachs*‡.

OF

* When SANCTORIUS eat MUTTON, which was a food peculiarly grateful to his stomach, his *feelings* were *pleasant*, and his *perspiration* *copious*;—when he eat PORK, GOOSE, DUCK, MUSHROOMS, or MELONS, he was *heavy* and *oppressed*; and found, by the balance, that his *perspiration* was *diminished* one half. This proves that even the *perspiratory discharge* is very much under the influence of the STOMACH.

† Very few exceptions to this rule. The plainest puddings are generally very compound.

‡ THE ART OF COOKERY I am apt to liken to the diabolical art of *undermining a town*. We all avoid the *red poison berries*, and caution others against

OF DRINKING AFTER MEALS.

A foreigner was invited to a party consisting, as he was told, of *English philosophers*, of whom he conceived a great deal. After a very plenteous dinner the cloth was cleared, and the bottles were placed on the table.

them, though we give our FRIENDS *poisoned pickles, and preserves made in copper saucepans, &c.* and hold out such temptations to *over-gorging*, which weak minds cannot resist.

They dine
 with dishes tortur'd from their native taste,
 and mad variety, to spur beyond
 its wiser will the jaded appetite !
Is this for pleasure ?—Learn a juster taste ;
 and know, that TEMPERANCE IS TRUE LUXURY.
Or is it pride ?—Pursue some nobler aim.
 Dismiss your parasites, who praise for hire ;
 and earn the fair esteem of honest men,
 whose praise is fame: Formed of such clay as yours,
 the sick, the needy, shiver at your gates.
 Even modest want may bless your hand unseen,
 though hush'd in patient wretchedness at home.
 Is there no virgin, graced with every charm
 but that which binds the mercenary vow ?
 No youth of genius, whose neglected worth
 unfoster'd sickens in the barren shade ?
 No worthy man, by fortune's random blows,
 or by a heart too generous and humane,
 constrain'd to leave his happy natal seat ?
There are, while human miseries abound,
a thousand ways to waste superfluous wealth.

ARMSTRONG.

He

He was pressed after five glasses to drink on; but the stranger persisted in assuring the company "*he felt no drought.*" These *philosophers* began then to be *angry*, and the foreigner rang the bell, and *insisted* on another course, for *they* ought, as much to *eat* against reason and inclination, as *he* to *drink*.

I would here recommend the excellent saying, *a glass for digestion, another for my relations, a third for my king, a fourth for my country, and a fifth for my enemy.*

It will not, I think, admit of a doubt, that *beer* or *water* is the only drink necessary in *early youth*; and that *wine*, and *spirituous liquors*, of which luxury has introduced a variety, ought to be appropriated solely to the *middle period*, to the comfort of *invalids**, and the invigoration of *old age*.

To

* The great objection, however, against *geneva* and *water*, and *brandy* and *water*, is, that *invalids* are very apt to increase the proportion of the spirit ordered, and the great Dr. FOTHERGILL, who was among the first who gave sanction to this practice, declared, some time before his death, that he repented of having done so, from the *unfortunate habit* that had *stole* on some of his patients.

On pleasure's flowery brink we idly stray,
masters *as yet* of our returning way.
Seeing no danger—we disarm our mind,
and give our conduct to the waves and wind.

Then

To the credit of the present age, *hard drinking* is rarely practised by persons of liberal education; though, from the habit of sitting at table some hours after dinner, we are tempted to *exceed* in the quantity of wine; which even with persons in health too frequently destroys in time the tone of the stomach.

Were the pleasure of the palate lasting, says CORNARO, there would be some excuse for inebriety, but it is so transitory, that there is scarce any distinguishing between the beginning and the ending; whereas the diseases it produces are very durable. This fact is well known in the distilleries,

Then in the flowery mead, or verdant shade,
to wanton dalliance negligently laid,
we weave the chaplet, and we crown the bowl,
and smiling see the *nearer waters* roll,
till the strong gust of raging passions rise,
till the dire tempest mingles earth and skies,
and swift into the boundless ocean borne,
our foolish confidence too late we mourn;
round our devoted heads the billows beat,
and from our troubled view the lessening lands retreat.

PRIOR.

Spirits, says the Abbe RAYNAL, were the gift the most fatal the old world ever made to the new. It was soon observed, that it disturbed their domestic peace, deprived them of their judgment, and made them furious. In vain did some Frenchmen expostulate with them, and endeavour to make them ashamed of *these excesses*. "It is you," answered they, "who have taught us to drink this liquor, and we cannot do without it. You have done the mischief, and it admits of no remedy."

where

where the SWINE which are fattened by the spirituous sediments of barrels, all acquire *diseased livers*.

Mark what happens to that man who drinks a quart of wine or of ale, if he has not been habituated to so violent and exhausting a stimulus. He loses the use both of his limbs and of his understanding! He becomes a temporary idiot, and has a temporary stroke of the palsy! And though he slowly recovers after some hours, is it not reasonable to conclude, that a frequent repetition of so powerful a poison must at length permanently affect him?—If a person accidentally becomes intoxicated by eating a few mushrooms of a peculiar kind, a general alarm is excited, and he is said to be poisoned; but so familiarized are we to the intoxication from vinous spirits, that it occasions merriment rather than alarm.

The story of *Prometheus* seems to have been invented by physicians in those ancient times, when all things were clothed in hieroglyphic, or in fable. *Prometheus* was painted as stealing *fire* from heaven, which might well represent the inflammable spirit produced by fermentation; which may be said to animate or enliven the *man of clay*: whence the conquest of *Bacchus*, and heedless mirth and noise of his devotees.—*But the after punishment of those, who steal this accursed fire, is a vul-*

ture gnawing the liver; and well allegorizes the poor inebriate lingering for years under painful hepatic diseases.*

Drinking is undoubtedly the most miserable refuge from misfortune. It is the most broken of all reeds. This solace is truly short lived; when over, the spirits commonly sink as much *below* their usual tone, as they had before been raised *above* it. Hence a repetition of the dose becomes necessary, and every fresh dose makes way for another, till the miserable wretch is rendered a slave to the bottle; and at length falls a sacrifice to what at first, perhaps, was taken only as a medicine. No man is so dejected as the drunkard when the debauch is over. Hence it is, that those who have the greatest flow of spirits while the glass circulates freely, are of all others the most hipped when sober. It may be pleasant to get drunk, but the next day is a day of uneasiness, and the third ought to be a day of repentance. To those who drink to drive away care, I would recommend the careful perusal of the following lines.

Unhappy man, whom *sorrow* thus and *rage*,
two different ills, alternately engage.
Who drinks, alas! *but to forget*,—nor sees
that melancholy, sloth, severe disease,

* Dr. DARWIN.

memory

memory confused, and interrupted thought,
 DEATH'S HARBINGERS, lie LATENT in the draught,
 AND IN THE FLOWERS THAT WREATH THE SPARKLING BOWL
 VELL ADDERS HISS, AND POISONOUS SERPENTS ROLL.

PRIOR.

OF SUPPER.

A *late dinner* gives a long morning, and precludes the necessity of a hearty supper, and tea may become its substitute, and call together, to a cheap entertainment and the pleasures of social intercourse, a meeting of cheerful friends. Abstracted from the cares of the busy day, having no variety of objects to draw off the attention, viewing the expressive and brilliant countenance of those he is in converse with, with spirits gently agitated, and cares dispelled, he returns with the partner of his choice, from the splendid circle, and wakes the next morning refreshed by a sound and tranquil sleep.

3. OF OLD AGE.

The *food* proper for *old age* has been before considered, when discoursing on *temperaments*.

SECT. XI.

ON VITAL, OR OXYGEN, AIR ENTERING

INTO

THE COMPOSITION OF OUR BODY.

A LAD, at Newmarket, having been almost starved, in order that he might be reduced to a proper weight for riding a match, was weighed at 9 o'clock in the morning, and again at 10 o'clock, and he was found to have gained near 30 ounces in the course of an hour, though he had only drank *half a glass* of wine in the interval *. A gentleman in the city was lately weighed before dinner, and was highly offended to find from his weight, not long after dinner, that he must have eat, unless some deceit was played on him, above *two pounds* of beef-steaks.

The reader will here call to mind the Section "*On the Balance betwixt Respiration and Digestion* †," and will discover, perhaps, the solution in part of this difficulty from

* From Dr. WATSON's Chemical Essays.

† The quantity of air consumed in a minute by us is a *gallon*: under certain circumstances it is *more*, according to the *quantity* and *nature* of the food.
The

from the increased attraction of the blood for the *vital*, or *oxygen*, *portion* of the *air*: for, from careful and repeated experiments, it appears, that the absorbents of the skin do not act, unless when violently irritated, the cutis serving as a covering to the mouths of these vessels*.

It is impossible, says the author of the *Medical Spectator*, indeed, to peruse the following extract from a late publication of Dr. BEDDOES without feeling the warmest approbation, and the most anxious desire to co-operate with him and Drs. DARWIN, EWART, THORNTON, and those other physicians whose letters he has published, in their laudable attempts to render the PNEUMATIC CHEMISTRY *useful to mankind*.—These, I am well per-

The quantity of air then consumed in an hour, and the weight of the *oxygen portion* being deducted, and added to the weight of the food taken into the stomach, would give some ground for conjecturing the weight of air acquired in a day.

* The hands and arms of several persons were plunged into water in which *muriated mercury* was dissolved, and no effects were produced where the skin was entire: but the same quantity of water and mercury remained. Again, *scammony* was applied to the body by means of a plaster: but it produced no visible effect. However, when an *irritation* was made, and the rampart of the skin was destroyed, it operated, as though it had passed into the bowels by means of the stomach. No water was absorbed either in the cold or hot bath. See the Memoir of Mons. SEGUIN, in *La Médecine Eclairée par les Sciences Physiques*.

suaded, must be the sentiments of every medical man, who possesses a ray of true science; and to me, it is particularly pleasing, because I also have many years ago entertained an opinion nearly similar. "A firm persuasion," says Dr. BEDDOES, "had long settled on my mind, that the system might be as powerfully and as variously affected by means of the lungs as of the stomach. And the more knowledge we have acquired of the properties of elastic fluids, the more has this my opinion been confirmed. Of all the functions, RESPIRATION is, I think, the best understood; and it will also be found in philosophic and cautious hands to be the most easily managed. It is impossible, adds Dr. BEDDOES, now to doubt, that we are NOURISHED BY THE LUNGS, AS TRULY, AS BY THE STOMACH; and that what we take in at the former entrance becomes, like our food, a part of the substance of our solids as well as our fluids.—By the lungs we can also introduce EFFECTUAL ALTERATIVES of the blood, and by consequence act on all the parts nourished by the blood. For some time," adds this illustrious philosopher, "I breathed OXYGEN AIR, with a certain portion of atmospheric air, and I FELT AT THE TIME OF INSPIRATION THAT AGREEABLE GLOW AND LIGHTNESS OF THE CHEST, WHICH HAS BEEN
 "DESCRIBED

“ DESCRIBED BY DR. PRIESTLEY AND OTHERS,
 “ IN A VERY SHORT TIME I PERCEIVED A GENI-
 “ AL WARMTH, AND A GREATER FLOW OF SPI-
 “ RITS THAN USUAL, AND BY DEGREES MY COM-
 “ PLEXION FROM AN UNIFORM BROWN BECAME
 “ FAIRER AND SOMEWHAT FLORID. I PERCEIVED
 “ ALSO A CARNATION TINT AT THE END OF MY
 “ FINGERS, AND MY LIPS BECAME OF A BRIGHT
 “ RED.”

“ *I even think it probable, that OXYGEN, or VITAL*
 “ *AIR, which, by uniting with the blood, creates such*
 “ *a beautiful colour to the complexion, may supersede all*
 “ *other cosmetics; one decisive advantage it will cer-*
 “ *tainly have over them all, for while it improves the*
 “ *looks, it will, if rightly administered, amend the health*
 “ *also*.*” The latter part of this experiment points out
 the analogy there is betwixt *exercise* † and *our inhaling*
a super-oxygenated atmosphere; and places, in the
 strongest point of view, that *oxygen, or vital, air*, by
 blending with the *blood*, becomes one of the CONSTI-
 TUENT PRINCIPLES of our body.

* From Dr. BEDDORS's Letter to Dr. DARWIN, on the New Method of
 curing Pulmonary Disorders.

† Vide the Section on *Exercise*, and the Experiment which proves that
 vital air is absorbed by the blood, page 70.

ON CLOTHING.

SECT. XII.

1. *Of the Clothing of Infants.*

MIDWIFERY was first practised by women. Hence the dressing of children became an art which few could attain unto. Each midwife strove to outdo all others in this pretended knowledge. These attempts were seconded by the vanity of parents, who, too often desirous of making a show of the infant as soon as it was born, were ambitious to have as much *finery* heaped upon it as possible. Thus it came to be thought as necessary for a midwife to excel in bracing and dressing an infant, as for a surgeon to be expert in applying bandages to a broken limb; and the poor child, as soon as it came into the world, had as many rollers and wrappers applied to the throat* and body, as if every bone had been fractured in the birth; while these were often so tight, as not only to gall and wound its tender frame, but

* As the *long stay* to hinder the child from bending back the head and breaking its neck!

even to obstruct the motion of the organs necessary for life.

NATURE knows no other use of clothes but to keep the body *warm*. All that is necessary for this purpose, is, when the child is born, to excite the external circulation by rubbing it with brandy and water with the warm hand, and having affixed the *belly-band* made of *fleecy hosiery**, to wrap it in a loose covering of the same soft material; and then to lay it by the side of the fond mother to partake of *her* vital warmth†. Were parents left to the dictates of nature alone, they would certainly follow this method. If we consider the body of an infant as a bundle of soft pipes, replenished with fluids in continual motion, the danger of *pressure*‡ will appear in the strongest light. NATURE, in order to make way for the growth of children, has formed their bodies soft and flexible; and lest they should receive any injury from pressure in the womb, has surrounded the foetus every where with yielding fluids. This shews the care

* More will be said hereafter of this happy discovery. At the same time that it is *warm* and *unirritating*, it is perfectly *elastic*.

† Vide Section VII. Part II. *How life depends on a certain degree of heat in the body.*

‡ Some allowance ought likewise to be made for the swelling of the muscles during sleep.

which

which NATURE takes to prevent all unequal pressure on the bodies of infants, and to defend them against every thing that might in the least cramp or confine their motions.

Not only the analogy of other animals, but the very feelings of infants, inform us, they ought to be kept easy and free from pressure. They cannot indeed tell us their complaint; but they can shew signs of pain; and this they never fail to do, by crying when pinched by their clothes. No sooner are they freed from their bracings, than they seem pleased and happy; yet, strange infatuation! the moment they hold their peace, they are again committed to their chains. I have known, says the benevolent Dr. BUCHAN, numerous children seized with *convulsion-fits* soon after the midwife had done swaddling them, who, upon taking off the rollers and bandages, were immediately relieved, and never had that disease afterwards.

SECT.

SECT. XIII.

2. *Of the Clothing of Adults.*

WE have before seen the benevolent care of PROVIDENCE to the lower order of creatures in providing them with CLOTHING *suited to the climate and the season of the year* *. The horse, the deer, and birds, *double* their covering in the beginning of the cold season, and *shed* it in the spring when a warm garment is no longer serviceable.—The beaver removed to the higher latitudes exchanges its fur, and the sheep its wool, for a coarse hair, *to allow of the escape of heat*. The coarse and black shag of the bear, on the contrary, is converted in the arctic regions into the finest and whitest fur *to retain the vital flame*.—In short, the softness and density of hair in animals seems always in proportion to the coldness of the country. The Canadian and Russian furs are therefore better than the furs of climates farther removed from the north. It is well known that the fur

* Vide what was said Sect. II. Part II, *On Animal Heat*; also Sect. III. *How Life depends on a certain Degree of Heat in the Body*; and Sect. IV. *On the Method Nature takes to increase or rid herself of this subtle and penetrating Fluid*.

of the ermine is the most valuable of any hitherto discovered: and it is in winter only that this little animal has it of the proper colour and consistence. NATURE has provided some animals with another resource; when the season becomes too cold for their constitutions, they sleep † or emigrate into warmer climates.

Pliny, one of the most celebrated naturalists of antiquity, pathetically laments, “that whilst NATURE has
“ given various clothing to the brute creation, and even
“ fenced plants and trees with bark, against the injuries
“ of the cold and heat, she would have cast man into
“ this world naked and unprovided against the inclemency of different climates and seasons.” But instead of agreeing with that philosopher, that NATURE has, in this particular, acted more like a cruel step-mother, than a kind and indulgent parent to man, we cannot sufficiently extol her providence and wisdom. It was no more than consistent with equity to provide the irrational part of her works with clothing suitable to their circumstances; but man, whom she endued with the transcending faculty of *reason*, she hath very wisely left to accommodate himself to the difference of seasons and of climate, and to clothe himself accordingly with

† Vide note *, page 95,

the plumes, the fleeces, the skins of animals, and the products of various plants and trees. This would invariably be found to be the case, were not man, alas! fervilely imitative, and in the highest degree capricious in the ornaments of his person! Hence it is, that the nations beyond the *Indus*, as well as the *Tartars*, are at great pains to compress their eyes at the corners, and to stretch their ears by heavy weights appended to them, and pulling them frequently with the fingers, so that they may hang down to their shoulders, which *they* consider as the highest beauty. On the same principle, they extirpate the hair from their bodies; and, on the face, they leave only a few tufts here and there. The *Tartars* frequently extirpate the whole hair of the head, except a knot on the crown, which they braid and adorn in different manners. Some, and among others the *Turks*, cut the hair off their heads, and let their beards grow. The *Europeans*, on the contrary, shave their beards, and wear their hair. Every nation seems to have entertained different prejudices, at different times, in favour of one part or another of the beard. Kingfon assures us, that a considerable part of the religion of the *Tartars* consists in the management of their whiskers; and that they waged a long and bloody war with the

Persians, declaring them infidels, merely because they would not give their whiskers the *orthodox* cut. PETER the Great had nearly occasioned a revolution in his kingdom, by wishing to have his subjects shaved. In our country we daily see men, who encourage the growth of the hair on the cheek, below the ear, to look fierce, while others again wish to have the size of their understanding measured by the size of their heads. The largeness of the doctor's wig* arises evidently from the same cause as the smallness of the beau's queue. In *Arabia* and *Greece* large eyes are esteemed beautiful; and in these countries they take extraordinary pains to stretch the lids, and extend their aperture. Among some *Indian tribes* in *America* they flatten the forehead in infancy by the application of broad plates of lead, and file to a point

* The tye-wig was disused in England through the humour of Dr. SOMERVILLE. Some of the faculty having taken offence, that he came not unfrequently to George's unarrayed with the sword, and in coloured clothes, and being on that account one day openly insulted by his indignant brethren, he came the next day to the coffee-house, having on the jehu of his coachman, who, on the contrary, had on the doctor's tye. "Here, gentlemen," he said, "is an argument to the purpose, that knowledge does not consist in exteriors. There are none of you, who would trust me to drive you, and the world shall soon see, also, as I pass through the streets of London, THAT THE WIG DOES NOT CONSTITUTE THE PHYSICIAN." Having made for several days this curious exhibition, the tye-wig was quickly converted into a subject of ridicule.

all

all the teeth to imitate the canine. In *Africa* they flatten the nose, to accomplish *their* idea of beauty. The skin in many nations is darkened by art; and all savages esteem certain kinds of deformity to be perfections; and strive to heighten the admiration of their persons, by augmenting the terror of their features. In *China*, the reigning fashion is still more contemptible, to appear *ever idle*, they suffer their finger nails to grow to an enormous length, and *pinch their feet* into the smallest size imaginable. The latter custom has unfortunately reached these kingdoms. Instead of having the size and figure of the shoe adapted to the shape of the foot, the toes must be cramped, and deprived of all separation, which the perspiration of that part seems to demand*, and nine tenths of mankind are troubled with corns, a complaint that is seldom or never occasioned but by narrow and pointed shoes. The ladies, who ever improve on the fashions of the time, to gain a little in height, lengthen out the heel, and constantly walk on *tiptoe*. The consequence of which is, acting contrary to the intentions of NATURE, they never seem to walk well, and as the fibres of the muscles of the calf are not

* Dr. VAUGHAN, of Rochester, recommends stockings to be made with the separation like gloves.

drawn

drawn into their due tension, they become subject to frequent and incurable *cramps*, which, as disturbing sleep, is again the remote cause of other dreadful disorders.

The shape God has given is too often attempted to be *mended* by dress, and those who know no better, believe that mankind would be frights without its assistance. The bones of growing persons are so cartilaginous, that they readily yield to the slightest pressure, and easily assume the shape of the mould in which they are confined. Hence it is that so many girls in proportion to boys are misshapen*. Deformity of body may indeed proceed from weakness or disease; but in general, says Dr. BUCHAN, it is the effect of improper clothing. The pressure of the abdomen by stays impedes the action of the stomach and bowels, and the motion necessary for respiration, and consequently the just circulation of the blood. Hence a train of dreadful disorders ensue. The pliancy of the body, and the natural

* A lady in the city, who had had no girls, though her family was numerous, but were *misshapen*, consulted the celebrated anatomist Mr. CLINE, on the prevention. "To have no stays—and to let the next girl run about like the boys," was the excellent advice of this gentleman, which being complied with, neither she or any of the future children were afterwards *marred* by the ill-placed attention of the ignorant mother. This story Mr. CLINE is very careful to deliver in his public lectures at St. Thomas's Hospital twice a year.

grace of the female form, is prevented by this rigid coat of mail. The imprudent zeal of the mother for a fine shape performs another most unkindly office to the child. She frequently becomes either incapacitated for marriage, or dies in child-birth. The madness in favour of stays seems, however, to be somewhat abated; and it is hoped the world will, in time, become wise enough to know, that the human shape does not solely depend upon whale-bone and bend-leather.

In *England* we seldom enjoy any continuance of settled weather, except towards the close of summer, and the beginning of autumn, and even then we are frequently balked in our expectations. The sudden changes that take place during three fourths of our year may be regarded as no less prejudicial to the health, than disagreeable to our feelings; and our terrors of *catching cold*, which have frequently appeared ridiculous to foreigners, are really better founded than we ourselves are apt, most of us, to apprehend; *colds* in their consequences proving fatal to thousands every year. Though we cannot hope entirely to escape the unpleasant sensations, or altogether to ward off the fatal effects occasioned by this caprice of our climate; yet considering properly *the nature of clothing*, we may avoid much of
the

the danger. If *ladies* are subject to *catch cold* more frequently than men, it is not *alone* their delicacy of constitution, or their being more confined within doors; but the frequent changes they make in the quality or quantity of their garments, and sometimes, however fearful of a partial current of air, because they expose even those parts of the body, that a little before had been warmly covered. If a greater proportion of females fall victims to *consumption*, is it not because, losing sight more than men of its primary purpose, says Dr. BEDDOES, they regulate their dress solely by fantastic ideas of elegance? If happily our regret should recal the age of chivalry,—to break the spell of fashion would be an achievement worthy the most gallant of our future knights. Common sense has always failed in the adventure; and our ladies, alas! are still compelled, whenever the enchantress waves her wand, to expose themselves, half undressed, to the fogs and frosts of our island.

It is, I believe, adds the celebrated Dr. BEDDOES, unfortunate for the inhabitants of this country, that we are not subject to such a continued severity of cold, as should oblige us regularly to fortify ourselves by warm clothing. By linen, worn exclusively, we lose more in health than we gain in comfort; which comfort is,

perhaps,

perhaps, after all, is merely imaginary; for from the representation of Dr. THORNTON, he appears to have supported the remarkable heats of a very hot summer, better than most other persons, by having on, instead of linen next his skin, a *fleecy hosiery waistcoat* *.

It is a mistaken notion, says Sir BENJAMIN THOMSON, that flannel is too warm a clothing for summer. I have worn it, says he, in the hottest climates, and in all seasons of the year, and never found the least inconvenience from it. Sir BENJAMIN moreover adds, I shall be happy if what I have said or done respecting *flannel* † should induce others to make a trial of what I have so long experienced with the greatest advantage, and which I am confident they will find to contribute greatly to health, and consequently to all the other comforts and enjoyments of life. As being the most effectual method

* Vide his Letters as published by Dr. BEDDOES, in which he adds, “and since my first using this under garb, I am not subject to catch cold as formerly from the vicissitudes of the weather.”

† Had Sir BENJAMIN THOMSON known the *fleecy hosiery*, he would most probably have recommended it in preference to *flannel*. It equally attracts and imbibes the moisture of the skin: but the former as being *elastic* embraces the body, as being from an animal substance is warmer and lighter for wear than flannel, and as being of a *softer texture* does not unpleasantly and injuriously irritate the skin.

to escape the influence of sudden changes of atmospheric temperature, and because flannel is so much less unpleasant, when moist, than linen. *Fleecy bosiery* or *flannel* should be worn during every season in Great Britain; and those who feel it necessary may add above the linen in winter a cotton under waistcoat, which he may put off during the warm weather, and resume again in the autumn. The philanthropic JONAS HANWAY was a very great advocate for *warm clothing*. Being in a decline, he was ordered by his physicians to the south of France: but some very urgent business calling him to visit Holland, in the moist air of that country he speedily recovered, and remarks that the Dutch are free from this dreadful calamity, which he attributes partly to the air *, and partly to their warm method of clothing. He adds, if a number of persons meet in a room, where there is no fire, and they feel cold, no pleasant conversation takes place, and *warm clothing* ought therefore to be used,

* Those consumptive patients, whom we hurry off to the clear air in the south of France, the *French physicians*, on the contrary, order to the foggy air of Lyons. As they cannot both be right, and as the HOT WELLS favours the sentiments of the latter, being near a great town, where innumerable works are carrying on, and situated on the borders of marshy ground, and a river the most choaked up with mud of any in the world, there is some probable grounds for doubting of the justness of our prevailing practice. Vide the Section on *Phthisis Pulmonalis*.

if for no other reason than for the preservation of *good humour*. BOERHAAVE's favourite receipt for health was, "to leave off our winter clothing on Midsummer day, and to resume it the day following."

To keep an animal in health, beside the retaining of a due degree of animal heat*, there must be a continued generation of new juices, and a perpetual discharge of the old. Without the due quantity of *PER-SPARATION*, which in a great measure depends on our clothing, neither the vegetable or animal can continue in health; a plant whose *perspiration* is stopt becomes sickly and dies; and an egg whose shell has been covered with a varnish, and the *perspiration* stopt by this means, will produce no living animal, either by the application of common heat, or that of incubation from the hen. The celebrated SANCTORIUS affirms, that the insensible perspiration alone discharges more than all the sensible evacuations together; and that the proportion of this to all the other evacuations, is as 5 to 3: though this proportion varies in different ages, climates, and constitutions, yet is it of such importance in all, that where it is in any considerable degree deficient, a

* Vide Sect. IX. on the Necessity of a due Quantity of Animal Heat to support the Vital Functions, p. 93.

diseased state of the body must ensue. The matter of *insensible perspiration*, or in other words, the subtile vapour that is continually exhaling from the surface of the body, is not secreted by any particular glands, but seems to be derived wholly from the extremities of minute arteries, that do not terminate in veins, and are every where dispersed on the surface. These *exhaling vessels* are easily demonstrated in the dead subject, by forcing water into the arteries; for then small drops exude from all parts of the skin, and raise up the cuticle, the pores of which are closed by death; and in the living subject, a looking-glass placed against the skin, is soon obscured by the vapour. When the perspiration is by any means increased, and several drops that were insensible when separate, are united together, they form upon the skin those visible drops called *sweat*. This particularly happens after much exercise, or whatever occasions an increased determination of fluids to the surface of the body; a greater quantity of perspirable matter being in such cases carried through the passages that are destined to convey it off.

Now the reason of the propriety of *fleecy bosiers* in *summer* is, that though it promotes the perspiration, it equally favours its *evaporation*: and we know that *eva-*
poration

poration produces *positive cold*, the *aqueous discharge* being the means designed by Nature for carrying off the superabundant heat * whether arising from climate, exercise, or fever.

In CHILDREN, where the food is continually combining with oxygen, and the fibres are irritable, it is of the utmost consequence to keep the body temperate, but never to suffer it to get *chilled*. Thus, without being enervated, they may escape the bad consequences arising from the sudden changes in this inconstant climate; for it is not true, that cold hardens *children* as it hardens *steel*. If delicate children are subject to diseases and danger in ENGLAND, to which they would not be subject in the warmer climate of ITALY, is it not evident that *the difference* between the climate of ENGLAND and ITALY is the cause of these diseases and dangers? I firmly believe, says Dr. BEDDOES, that the greatest mortality is among those children who are hardily brought up. Nearly one third of the poor, born in this island, sink into the tomb, as soon almost as they have caught a few glimpses of the light of heaven. And even when

* Vide Sect. X. p. 96. "on the Means NATURE employs to rid herself of too much internal Heat." When dogs are exercised, who do not perspire, they carry off the superabundant heat by the *kidneys*, as well as by the *tongue*.

they

they have weathered out the early inclemencies of their station, unless they afterwards wear warm and comfortable clothing *, they enjoy no such advantage of freedom from *pulmonic complaints* as we are taught to imagine. Among the peasantry of *Warwickshire* and *Staffordshire*, I am creditably told that *consumptions* are not less frequent, than among the better order of people who are more delicately bred up.

FAT PEOPLE need a less warm-raiment than those that are lean; for oil, as being a bad conductor of heat, acts as a fleecy hosiery waistcoat, reflecting back the vital warmth. Here we cannot but admire the benevolent care of PROVIDENCE to the lower order of animals, by giving the whale, the bear, and other animals who inhabit the colder climates, a deep covering of fat.

OLD PEOPLE, as requiring *abundant excitement*, ought more especially to be warm clad, and rather to exceed, than to be deficient in the quantity of their clothing, and to wear that which affords them the greatest warmth with the least possible weight. They will not then be liable to be injured by sitting all day in the chimney

* No people are better clothed than the *farmers* in this island, who usually enjoy *rude health*.

corner, breathing an unwholesome air, and in a current of wind. A person sufficiently clothed with the *fleecy hosiery* next his skin may wear any slight substance for ornament above it, and will, I am certain, feel more comfortable even at some distance from the fire, than when he was scorching on one side, and felt half frozen on the other.

The under garment of *fleecy hosiery* ought to be frequently changed, as it promotes the perspiration, and is continually absorbing it. Diseases of the skin are chiefly owing to want of cleanliness. They may indeed proceed from other causes; but they seldom continue long where cleanliness prevails. To the same cause must we impute the various kinds of vermin which infest the human body, &c. These may always be banished by cleanliness alone, and wherever they abound, we have every reason to believe it is neglected. It is remarkable that, in most eastern countries, cleanliness makes a great part of their religion. Indeed the whole system of the Jewish laws has a manifest tendency to promote cleanliness. Whatever pretensions people make to politeness and

and civilization, I will affirm, that as long as they neglect cleanliness and appear nasty, they are stiled Goths and barbarians. Cleanliness is certainly agreeable to our nature. It sooner attracts our regard than even finery itself, and often gains esteem where that fails. It is an ornament to the highest as well as the lowest station, and cannot be dispensed with in either.

Few things are more unreasonable, than the dread of cleanliness in sick people. They had rather wallow in all manner of filth, than change a tatter of their apparel. Yet how refreshed, how cheerful, how comfortable do people feel when in health upon being shaved, washed, and shifted! If cleanliness be proper for persons in health, it is certainly more so for the sick. By being neglected the slightest disorders are often changed into the most *malignant*. The same mistaken care which prompted people to prevent the least admission of *fresh air* to the sick, seems to have induced them to keep them dirty*. If the *fleecy*
poetry

* Dr. BUCHAN.

I here take my final leave of the *Domestic Medicine*, a work certainly of merit: yet I cannot help remarking, that the benevolent author of it has idly attempted to make ignorant old women skilful *practitioners*, and that

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hosiery waistcoat was changed on going to bed, which is the time we are in the habit of being exposed to cold, there can be no danger of catching cold, nor can there be any impropriety of doing this at least twice a week in the summer, and once in the winter. The only caution necessary, is to see, previous to its being put on, that it contains no dampness.

PHYSIC WITHOUT PHILOSOPHY is mere QUACKERY, and THE DESTRUCTION OF THOUSANDS. Vide Law II. *On the State of Exhaustion* produced in the irritable Fibre by the *injudicious* administration of STIMULI.

The discharge from the skin is, 1st, two parts *fixed air*; and, 2dly, one part *azotic air*; and, 3dly, a quantity of *aqueous fluid*, containing the *different salts* of the body.

The surface of the body is also found to separate the *oxygen air* from its combination with *azotic*, and to imbibe it.

These discoveries, begun by Mr. CRUICKSHANKS, and confirmed by Mr. ABERNETHY, both eminent teachers of anatomy in *London*, have led some able physiologists of the present day to suspect that, 1. *fixed air*, 2. *azotic air*, and, 3. *water*, are sent forth at each expiration from THE LUNGS, while the *oxygen air*, in lieu of these, is imbibed by the blood, and they have inculcated a new theory of respiration.

Experiments, we are informed, have been instituted by Dr. BEDDOES at the Hot Wells, Bristol, and Dr. THORNTON in London, to ascertain the products of *expiration* after *inhaling* different kinds of air, which will probably decide this controversy. (Compare with this note Sect. VI. Part II, ON RESPIRATION.

OF MENTAL STIMULI.

SECT. XIV.

OF VISION.

WHEN the sun rises on the face of the earth, *all nature* seems to have received *a new creation*. What *majesty!*—What *splendour!*—What *beauty!*

We will attempt, in as familiar a manner as possible, to explain to the attentive reader, *the nice mechanism* by which the sight is thus capable of communicating to the mind these *lively, varied, and abundant perceptions*.

In relation to the following law, “*that the rays of light are refracted (or turned inwards) according to the density of the medium through which they pass,*” our eyes consist of 3 *distinct humours of different densities*, each lodged in a transparent capsule, viz.

1. The EXTERNAL, or AQUEOUS;
2. The CENTRAL, or CRYSTALLINE; and
3. The INWARD, or VITRIOUS.

Because light is subjected also to another law, the law of *reflection*, a DARK MEMBRANE lines the whole of the inside of the globe.

The OPTIC NERVE expands itself over the concave bottom of this darkened sphere, whose fibres, in a collected body, terminate obliquely * in the brain.

At the fore part of the eye there is, as it were, a *partition*, in the center of which a round orifice, called the PUPIL †, is seen, which contracts or dilates itself, to admit of more or a less degree of light, by means of the muscular fibres of the IRIS or UVIA ‡.

* This might be adduced as a beautiful illustration of the beneficent intention of THE DIVINE ARCHITECT. A vein and artery accompany this nerve, so that when an object strikes upon it, sight is prevented. From the obliquity of the entrance of the optic nerve this does not often happen, but may be made to appear, if you form a dark spot on a piece of paper, and shutting one eye, turn this paper about, until the spot strikes on the trunk of the optic nerve, when it will immediately disappear.

† This is the *small black circle* in the middle of the eye.

‡ Called *uvia* from its supposed resemblance to a grape, being usually grey or black. This part is surrounded *externally* by the white of the eye, and *internally* by the pupil. The iris or uvia of a greyhound being put into an alkalescent mixture by Dr. HAIGHTON, the *longitudinal fibres* were rendered visible. These *sympathize* with the optic nerve: for in gutta serena, or decay of energy in that nerve, the pupil remains unaltered in dimensions, however the light may vary. The *sympathy* of parts was before shewn, when discoursing on the synchronous action of the opposite sides of the heart, and is also displayed, when we irritate the nostrils, and excite into action the muscles of expiration, or when exciting the stomach by an emetic, the abdominal muscles, to favour each rejection, are thrown into convulsive efforts.

SIX MUSCLES* are placed behind, so as to turn this beautiful and useful organ on every side.

Thus have we a perfect CAMERA OBSCURA, with its different lenses; and the image painted in the darkened chamber of the eye (owing to the reflexion of the rays of light from the objects around), by affecting the optic

* The four right muscles arise near together from the bottom of the orbit, where the optic nerve enters, which they surround. The *one* lifts the eye directly upwards, *another* turns it downwards, a *third* draws the sight toward the nose, and the *fourth* turns it the contrary way. They terminate each in a broad, flat, and very white tendon, which covers all the fore part of the eye, up to the circle of the *cornea* (or outer convex capsule of the aqueous humour); and their white and shining tendons form that enamelled like part which surrounds the *coloured circle*, and which is, from its colour, named *the white of the eye*, or the *tunica albuginea*, as if it were absolutely a distinct coat.

So perfectly balanced are these muscles, that if they act all at once the eye is immoveably fixed. So that sometimes in an operation the eye is found more firmly set than it could be either by instruments or the finger.

The two oblique muscles deserve also particular attention. The *inferior oblique* arises from the orbit, and obliquely descends into that cavity to be inserted under the eye-ball; and the *superior oblique*, on the contrary, arises along with the recti muscles, but sends forth a long tendon, which passes through a ring near the nose, and by this beautiful contrivance, it gets inserted into the upper part of the eye-ball. They project the eye forward, as when we strain to see distant objects.

Brutes have *another muscle* not found in our eyes. A surgeon attempting to extract the cataract from the eye of a blind horse, discovered this by accident, for as soon as the eye was touched, it receded deep into the head. This could be effected only by this *seventh* muscle; which therefore seems to be provided for defending the eye, by drawing it thus into the orbit, in creatures who have no hand, like us, to screen the eye upon the approach of danger.

nerve,

nerve, presents to the mind the varied and agreeable impression.

Should it be inquired, “ *in what way* the optic nerve conveys the image of the objects around; and whether this arises from *vibration*, or *the motion of some fluid*?” The answer is, it must be confessed, of very difficult solution. But it seems highly improbable that a *soft inelastic cord*, like a nerve, can *vibrate*, and no *inert heavy fluid* can *equal the quickness of perception*.

We are then induced, says the celebrated naturalist BONNET, to admit that there is a subtle fluid in the nerves, whose tenuity prevents our seeing it; and which serves alike for the propagation of sensible impressions, as muscular motion. The *instantaneousness* of this propagation, and *some other phænomena*, indicate that there is *a certain analogy* between *this fluid* and the *electric fluid* *.

As we know, indeed, that a sixth part of the whole mass of blood is driven to the brain from the heart in an *oxygenated* form, and quickly returns thence *unoxygenated* †, and is as speedily supplied by fresh *oxygenated*

* Vide Part II. Sect. XII. on *Muscular Motion*.

† Vide the representation of the heart, and observe the 2 *carotid arteries*, whose blood is returned by the 4 *jugulars*.

blood,

blood, it would be a pleasing, but difficult, attempt to prove that this quantity of blood, when passing into so small an organ as the brain, cannot be intended by frugal NATURE solely for nourishment, and the generation of vital heat, but must emit its caloric to be formed by the action of the brain into the *electric fluid*.

As the nerves of sight, and the other organs of sense, terminate in THE BRAIN, we have the highest reason to believe that THE SOUL is seated there.

A substance, therefore, indifferent to motion and rest, is related to a substance that thinks, and though unagitated by external impression, can generally at will regain the former connection. From this surprising bond there springs a reciprocal commerce between two distinct beings, a kind of action and reaction, which constitutes the life of organized sentient beings.

The brain may therefore be compared to a *cart blanche*, receiving every impression; and to a *cabinet*, wherein the different portions of the universe are painted in miniature, and may be drawn out at pleasure.

SECT.

SECT. XV.

OF HEARING.

As we saw different humours in the eye in relation to the laws of light, so we find a no less complicated structure of the ear in reference to the vibrations of the air. The uses, however, of the several parts forming the ear is not so well understood: but it behoves us, in contemplating the work of THE CREATOR, not to question the utility of any part; but to say, we find it here in this particular form; and therefore it must have its use.

The tremulous motions of the air are first received by the external ear. In men this part is much flatter than in brutes, but formed with certain folds, or inequalities, constituting a kind of winding passage for the air into the canal, which leads to the internal part of the ear.

THIS CANAL by its form would probably invite insects to make a lodgment in it, were it not defended by a tenacious and bitter substance, called the wax of the ear. But in birds, whose organs of hearing are sufficiently defended, no such secretion is observed.

Through

Through this canal the pulsations of the air are conveyed to a membrane, called MEMBRANA TYMPANI, stretched across it, and dividing the *external* from what is called by anatomists the *internal ear*.

From the tympanum, or drum, is an opening into the mouth. On one side of this passage, called THE EUSTACHEAN TUBE, there is a cartilage, to which there is affixed a muscle, by which the passage may be varied, just as the muscular fibres of the uvula vary the dimension of the pupil for the admission of light. This opening is of so much importance towards hearing, that those who are in some measure deaf, are generally observed to open their mouths when they listen, whereby the vibrations of the air have a freer passage to the tympanum*.

Within the tympanum are lodged FOUR SMALL BONES subservient to the office of hearing. These communicate with certain *bony* and *winding* CAVITIES †

* The charming contrivance for preventing the food from passing into the wind-pipe by means of a flexible covering, was before observed, and we may remark here a no less kind intention in PROVIDENCE towards man in furnishing him with the *uvula*, which, as the food is passing into the oesophagus, is drawn back, and closes the opening into the nose and Eustachean tube. Animals who are prone, not being subject to have any of their aliment pass through the nose, want therefore *this defence*.

† To wit, the *vestibulum*, *semicircular canals*, and *cochlea*.

lined on their inside with NERVOUS FILAMENTS, which go to the brain by a common trunk.

It is generally believed, that the *tympanum* of the ear vibrates mechanically, when exposed to audible sounds, like the strings of one musical instrument, when the same notes are struck upon another. Nor does this opinion seem improbable, as the muscles and bones of the ear seem adapted to increase or diminish the tension of the tympanum for the purposes of mechanical vibrations.

But it appears from dissection, that *the tympanum** is
not

* The situation of the *membrana tympani* is nearly horizontal in men and in brutes, which is the best position to receive sounds reverberated from the earth. In *them* it is *concave* outward; but in *birds* it is *convex* outward, so as to make the upper part of it nearly perpendicular to the horizon, which is best fitted for the receiving of sounds in the air. *This membrane* does not entirely close the passage, but has, says CHESelden, on one side a small aperture covered with a valve. I found it, says he, once half open in a man that I dissected, who had not been *deaf*; and I have seen a man smook a whole pipe of tobacco through his ears, which must go from the mouth, by the passage of the Eustachean tube, through the tympanum; yet this man *heard* perfectly well. These cases occasioned me to break the tympanum in both ears of a dog, and it did not destroy his hearing, but he was much shocked at any loud sounds. In very young children I have always found this membrane covered with a *thick mucus*, which seems kindly provided for them, to prevent loud sounds from affecting them too much. A gentleman well known in this city, having had *four* children born deaf, was advised to lay blisters behind the ears of the next children he might have, which he did to *three* which were born

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afterwards,

not the immediate organ of hearing, but that like *the humours of the eye*, it is only of use to *prepare* the object for the immediate organ. For THE AUDITORY NERVE is not spread upon the tympanum, but upon the VER-TIBULUM, and COCHLEA, and SEMICIRCULAR CANALS of the ear; while between the tympanum and the expansion of the auditory nerve the cavity is said, by Dr. MECKEL, to be filled with *water*; as he had frequently observed by freezing the heads of dead animals before he dissected them; and water being a more *dense fluid*

afterwards, and every one of these heard perfectly well. It seemed not unreasonable to suppose that too greater a quantity of this mucus upon the drum, or the deposition of coagulable lymph thrown out by inflammation, might be the cause of deafness in the *four* children, and that the discharge made by the blisters in the *three* latter cases, was the cause of their *escaping* the same misfortune. From these, and other like cases, it may be concluded, that the *membrana tympani*, though useful in hearing, is not the seat of that sense; and if any disease in that membrane should *obstruct* the passage of sounds to the *internal parts* of the ear, which are the seat of that sense, an artificial passage through that membrane might recover hearing, as the removing the *crystalline humour*, when that obstructs the light, recovers sight. Some years since a malefactor, who was deaf, was pardoned on condition that he suffered this experiment. As soon as this was publicly known, Mr. CHESELDEN, the lecturer on anatomy and surgery, and surgeon of St. Thomas's Hospital, was hooted and insulted in the streets, and having entered the theatre, the play was arrested by the cry of DRUM! DRUM! and he was obliged to leave the theatre, so violent at all times has been the *indignation* against men, who are inclined, from a philosophic conviction of truth, to *innovate*, or rather I might say, to *improve* the routine of things, and he was constrained by the public voice to desist from the attempt, and it is probable that the world will lose forever the benefits that might have resulted from this experiment!

than

than air, is much better adapted to the propagation of vibrations.

I shall not expatiate on *these reclusive parts*; only there is one special contrivance of the nerves ministering to this sense of hearing, which I think ought not to be passed by. One of the branches of the auditory nerves is distributed partly to the muscles of the *ear*, partly to the *eye*, partly to the *tongue* and instruments of *speech* *, and inosculated with the nerves that go to the *heart* and *breast*. By which means there is an admirable and useful *consent* between these parts of the body; it being natural for most animals, upon hearing any strange sound, to erect their ears, to open their eyes, and to be ready with the

* Every one in his childhood has repeatedly bit a part of the glass or earthen vessel, in which his food has been given him, and has thence had a very disagreeable sensation in *the teeth*, which sensation was designed by nature to prevent us from exerting them on objects harder than themselves. The jarring sound produced between the cup and the teeth is always attendant on this disagreeable sensation: and ever after, when such a sound is accidentally produced by the conflict of two hard bodies, we feel by association of ideas the concomitant disagreeable sensation in our teeth. Others have, in their infancy, frequently held the corner of a silk handkerchief in their mouth, whilst their companions in play have plucked it from them, and have given another disagreeable sensation to their teeth, which has afterwards recurred on running the finger along those materials. Dr. DARWIN.

A consent of parts may *also* exist, where the nerves cannot be traced as connected together. Vide note *, p. 132.

mouth to call out, or utter what the present occasion shall dictate. And accordingly it is very common for most animals, when suddenly surpris'd in sleep with any loud noise, presently to shriek and cry out, and display a great palpitation of the heart.

Hearing is a sense much more necessary to man than to animals. With these it is only a warning against danger, or an encouragement to mutual assistance. In man, it is the source of most of *his pleasures*; and without which his reason would be of little benefit.

A man born deaf must necessarily be dumb; and his whole sphere of knowledge will in all probability be bounded only by sensual objects. We have an instance of a young man, who, being born deaf, was restored, at the age of twenty-four, to perfect hearing: the account is given in the *Memoirs of the Academy of Science*, 1703.

A young man of the town of Chartres, between the age of twenty-three and twenty-four, the son of a tradesman, and deaf and dumb from his birth, recovered his hearing, and in three months, by unremitting diligence, he understood what was said to him, and could join tolerably well in conversation. Soon after, some divines questioned him concerning his ideas of his past state; and

and principally with respect to God, his soul, and the morality and turpitude of actions. The young man, however, had not driven his solitary speculations into that channel. He had gone to mass, indeed, with his parents, had learned to sign himself with the cross, to kneel down and assume all the grimaces of a man that was praying; but he did all this without any manner of knowledge of the intention or the cause; he saw others do the like, and that was enough for him; he led a life of pure animal instinct; entirely taken up with sensible objects, and such as were present, he did not seem even to make so many reflections upon these, as might reasonably be expected from his situation: and yet the young man was not in want of understanding; but the understanding of a man deprived of all commerce with others is so very confined, that the mind is in some measure totally under the control of its immediate sensation.

All nations, even the most barbarous, have their instruments of *music*; and what is remarkable, the proportion between their notes is in all the same as in ours. This, however, is not the place for entering into the nature of these sounds, their effects upon the air, or
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their

their consonances with each other. We are not now giving an history of sound, but of human perception.

All countries are pleased with *music*; and, if they have not skill enough to produce *harmony*, at least they seem willing to substitute *noise*. Without all question, noise alone is sufficient to operate powerfully on the spirit; and if the mind be already predisposed to joy, I have seldom found noise fail of increasing it into rapture. The mind feels a kind of distracted pleasure in such powerful sounds, braces up every nerve, and riots in the excess. But, as in the eye, an immediate gaze upon the sun will disturb the organ; so, in the ear, a loud unexpected noise disorders the whole frame, and sometimes disturbs the sense ever after.

SECT.

SECT. XVI.

OF THE TOUCH.

THE peculiar organ of this sense is *the skin*, which covers the whole body, it being needful that the surface should be provided with this sense, that nothing might come into contact with any part of our body, without being perceived.

If we consider the skin only, and reflect how accurately the mind distinguishes each particular portion, which is pressed by the several parts of any object, how surprising must it appear, that the nerves we find assigned to the skin, can supply such numbers of separate fibres, as are necessary for distinguishing in this manner the action upon each almost infinite minute part of so very extended a surface?

As one office of the skin is to be an emunctory, by which the redundancies or effete parts of the blood are thrown forth*; for this end it is furnished with numerous pores in every part of it. But between these

* See page 277.

pores arise, from the external surface of the skin, NERVOUS PAPILLÆ, very minute and contiguous to each other, by which the office of touch is performed.

These are defended by a *mucous substance** spread between the EXTERNAL and INTERNAL SKIN, which being every where pierced through by *these papillæ*, receives the name of RETE MUCOSUM.

Besides the pain consequent upon injuries done to the skin, the primary object of sensation in these PAPILLÆ seems to be *hardness* and *softness*: such bodies as give way to the touch, we call *soft*; others, which resist pressure, so as to cause the skin to yield under them, we call *hard*. And how happily is this sense tempered between the two extremes; being neither too acute nor too obtuse!

By the touch, we correct the error of vision. Naturally every object we see appears to be within our reach, for a child, who has as yet made but little use of

* This gluey matter, soon after birth, grows of a *yellow tinge*, which increases in our riper age. It is *darker*, as the climate is hot, and as we become more exposed to it, and under the line it is of a perfect *black colour*, forming the chief contrast between *black* and *white* men. Dr. BEDDOES, in the presence of some pupils who attended his chemical lectures at Oxford, having directed a *black* to immerse his hand in diluted oxygenated marine acid, the hand quickly became milky *white*; but the piebald negro resisted any further attempts. On the contrary, a French physician, it is said, by giving a reverend divine silver dissolved in the nitrous acid, converted him wholly into a *black*. Vide Dr. Beddoes' Works, and La Médecine Eclairée par les Sciences.

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his sense of feeling, would equally grasp at the moon as at objects within his reach. Mr. CHESELDEN, having couched a boy of thirteen for a cataract, who had hitherto been blind, and thus at once restored him to sight, has curiously marked the progress of his recovery. He was, at first, couched only in one of his eyes; and, when he saw for the first time, he was so far from judging of distances, that he supposed his eyes *touched* every object that he saw, in the same manner as his hands might be said to feel them. It may be for this reason, that we often see horses frightened at things, which they have not become acquainted with by means of their nostrils, which serve them in some respects like our hands.

It has been remarked, that even brutes are intelligent in proportion to the accuracy of their feeling, or as their extremities approach in resemblance to the human hand. The horse and the bull, whose feet are covered with callous hoofs, are less intelligent than the dog, and the dog is inferior in acuteness to the ape, who possesses a rude kind of hand.

This sense is the peculiar amusement of infants, and, as we before observed, perfects the sense of vision.

S E C T. XVII.

OF PAIN.

BUT different from this, and constituting another species of *feeling*, are those sensations arising from different disturbances in the animal machine.

All these various sensations are so distinct one from another, that scarce any two parts of the body feel the same species of pain. The *head-ach*, *tooth-ach*, *ear-ach*, though ranged under one general name, are yet very different kinds of sensation. The pain which the *bowels* feel in colics, is totally different from any of these; and the affection of the stomach, called *sickness* *, is peculiar to that part, this organ being liable to other species of pain also. Again, the pain felt in the *breast* from the breath being straitened, has no kind of analogy with any of these, the breast being also subject to other pains, inflammation, and the like. Nor are the several modes

* *Sickness* arises from *sensation*: hence it is always preceded by *nausea*. Van Swieten relates that SYDENHAM was once sick on seeing a putrid dead dog; coming past the same place *many years* afterwards, he felt a similar inclination to vomit. Hence if we cut the *par vagum*, the nerve leading to the stomach, no sickness can be excited in the dog by the most violent emetics.

of pain, to which our perishing bodies are subject in all their diverse parts, easily to be enumerated *. But these variations principally merit our attention, as the different sensations in the pains the same part is subject to, may, so far as they can be described, point out the cause of each, and direct to the proper methods for removing them.

These *stimulate* in proportion to their intensity and the sensibility of the part affected, and accordingly convey their impression to the sensorium, which has a power even to stifle a part of the stimulus by resignation, or else add to it by the impatience of the will.

* It is not meant that *the nerves* are different, but that they are like the nerves administering to taste, differently affected according to the stimuli applied; and possess also a difference in sensation, arising from the variety of structure in those organs to which they are connected. Vide the Sect. ON THE SENTIENT PRINCIPLE.

S E C T. XVIII.

OF THE SENSATION OF HEAT AND COLD.

THERE are many experiments in chemical writers, that evince the existence of HEAT as a *fluid element*, which covers and pervades all bodies, and is *attracted* by the *solutions* of some of them, and is *detruded* from the *combination* of others. Thus from the *combinations* of metals with acids, and from those *combinations* of animal fluids, which are termed *secretions*, this *fluid matter* of heat is given out amongst the neighbouring bodies; and in the *solutions* of salts in water, or of water in air, it is *absorbed* from the bodies that surround them; whilst in its *facility* in passing through *metallic bodies*, and its *difficulty* in pervading *resins* and *glass*, it resembles the *properties* of the ELECTRIC AURA; and is like that excited by *friction*, and seems like that to *gravitate* amongst other bodies in its *uncombined state*, and to find its *equilibrium* *.

There is no circumstance of more consequence in the animal oeconomy than a due proportion of this fluid of heat; for the digestion of our nutriment, and the con-

* Vide page 282.

version of it into chyle in the bowels, and the proper qualities of all our secreted fluids, as they are produced partly by animal and partly by chemical processes, depend much on *the quantity* of heat; the excess of which, or its deficiency, alike give us pain, and induces us to avoid the circumstances that occasion them.

And in this the perception of heat essentially *differs* from the perceptions of the sense of touch, as we receive pain from too much pressure of solid bodies, but none from the absence of it. It is hence conjectured that our CREATOR has provided us with *the nerve of touch*†, as distinct in itself as the optic, or any other nerve of sense, and *a set of nerves* for the reception of *this fluid*, which anatomists have not yet attended to.

There is another circumstance which would induce us to believe, that the perceptions of heat and cold do not belong to the organ of touch; since *the teeth*, which are the least adapted for the perceptions of solidity and figure, are the most sensible to heat or cold; whence we are forewarned from swallowing those materials, whose degree of coldness or of heat would injure our stomachs.

† Vide note *, p. 295, and the Sect. ON THE SENTIENT PRINCIPLE. This subject deserves to be more fully considered by both anatomists and physiologists.

The following is an extract from a letter of Dr. DARWIN of *Shrewsbury*, when he was a student at Edinburgh, to his friend Dr. DARWIN of *Derby*.

DEAR SIR,

I MADE an experiment yesterday in the hospital, which much favours your opinion, "*that the sensation of HEAT and of TOUCH* depend on different sets of nerves.*"

A man who had lately recovered from a fever, and was still weak, was seized with violent cramps in his legs and feet; which were removed by opiates, except that one of his feet remained insensible.

Dr. EWART, of *Bath*, pricked him with a pin in five or six places, and the patient declared he did not feel it in the least, nor was he sensible of a very smart pinch.

I then held a *hot iron* at some distance, and brought it gradually nearer, till it came within three inches, when he asserted he felt it quite distinctly.

I HAVE THE HONOUR TO BE, &c. &c.

* Might not this difference arise from the sensibility of the part being in some degree restored by the application of heat? Vide note *, page 142.

SECT.

SECT. XIX.

OF SMELLING.

THE infinitely small particles that are continually detached from the surface of odoriferous bodies, float in the air, which transports them every where, and being drawn into the nostrils by the breath, are applied to the membrane that is distributed in the bony cavity in the inside of the nose. THIS MEMBRANE is totally covered with infinite ramifications and convolutions of the ORFACTORY NERVES.

The great CREATOR, ever attentive to the ease and convenience of his creatures, has furnished the nostrils with a number of *glands*, or small arteries, which secrete a thick mucus, which defends the nerves from the slighter action of the air, or the too powerful stimulus of acrid odours.

Of all the senses, perhaps, there is not one in which man is more inferior to other animals than in that of *smelling*. A dog scents various kinds of game at considerable distances; and, if the fact were not confirmed by daily experience, it could hardly gain credit, that he

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can trace the odour of his master's foot through all the winding streets of a populous city !

In the selection of food, men are greatly assisted, even in the most luxurious state of society, by the sense of smell. By *smelling* we often reject food as noxious, and will not risk the other test of tasting. Victuals, which have a putrid smell, as equally offensive to our nostrils as hurtful to our constitution, we avoid with abhorrence ; but we are allured to eat substances which have a grateful and savoury odour. The more frequent and more acute discernment of brutes in the exercise of this sense is chiefly owing to their freedom, and to their using natural productions alone. But men in society, by the arts of cookery, by the unnatural assemblage of twenty ingredients in one dish, blunt, corrupt, and deceive, both their senses of *smelling* and of *tasting*.

It is not unworthy of remark, that, in all animals, the organs of *seeing*, *smelling*, and *tasting*, are uniformly situated very near each other. Here the intention of NATURE is evident. The vicinity of these three senses form a *triple* guard in the selection of food.

But assistance in the choice of food is not the only advantage that men and other animals derive from the
sense

of *smelling*. When our senses are not vitiated by unnatural habits, they are not only faithful monitors of danger, but convey to us the most exquisite *pleasures*. The fragrance of a rose, and the perfume of many other flowers, is not only pleasant, but gives a refreshing and delightful *stimulus* to the whole system, and may be considered therefore often as a species of wholesome excitement.

SECT. XX.

OF TASTE.

THE smell, as was before observed, has great connection with the taste. We often are directed by it in judging of our food; and that part of taste which we usually call *flavour*, is a mixed kind of sensation compounded after some manner from both. By the communication between the nose and mouth, the olfactory nerves seem capable of being affected that way; insomuch, that persons who are at the pains to prevent the access of air by the nostrils, swallow nauseous draughts without tasting them.

THE GUSTATORY NERVES, by which this sensation is received, rise upon the body of the *tongue* in a manner somewhat similar to those in the skin; for *PAPILLÆ* more visible than those of the skin (otherwise alike) appear in those parts of the tongue that are endued with this sense. *These* are always erected on the application of sapid or stimulating substances. This elevation and extension of the *papillæ*, by bringing larger portions of the nerves into contact with the substances

applied

applied to the tongue, give additional strength to the sensation, and enable us to judge with greater accuracy concerning their nature and qualities. The *saliva*, which perpetually moistens the tongue, is a liquor, which, though insipid itself, is found in all animals to be a very powerful solvent. Every substance applied to the tongue is partially dissolved by the saliva before the sensation of taste is excited. And hence when the tongue is rendered dry by disease, or any other cause, the sense of taste is either vitiated or totally destroyed.

The senses of *smell* and *taste* in many other animals greatly excel those of mankind, for in civilized society, as our victuals are generally prepared by others, and are adulterated with salt, spice, oil, and empyreuma, we do not hesitate about eating whatever is set before us, and neglect to cultivate these senses: whereas *other animals* try every morsel by the *smell*, before they take it into their mouths, and by the *taste* before they swallow it; and are led each to his proper nourishment by his organs of sense.

Nevertheless we may observe that *children*, having abundant excitability, are naturally inclined towards those foods which contain but little stimuli. And, on

the contrary, *those* who are *more advanced in life*, and whose excitability is blunted, are fond of the most poignant dishes. Every one must remember how great a pleasure he found in sweets and milk while a *child*. As he *grew older* he insensibly calls to his assistance spices, salts, and aromatics; and delights in those tastes which in childhood he was unable to endure.

The sense of taste is excited. And hence when the tongue is rendered dry by disease, or any other cause, the sense of taste is either vitiated or totally destroyed. The sense of smell and taste in many other animals greatly excel those of mankind, for in civilized society, as our victuals are generally prepared by others, and are adulterated with salt, spice, oil, and condiments, we do not hesitate about eating whatever is set before us, and neglect to cultivate those senses, whereas other animals try every morsel by the smell, before they take it into their mouths, and by the way, before they swallow it, and are led each to his proper nourishment by his organ of taste.

Nevertheless we may observe that calves, having abundant excubity, are naturally inclined towards those foods which contain but little smell. And on

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SECT.

SECT. XXI.

OF IMAGINATION.

AN animal may be said to fill up that sphere which he can reach by his senses; and is actually large in proportion to the sphere to which its organs extend. — By *sight*, man's enjoyments are diffused into a wide circle; — that of *hearing*, though less widely diffused, nevertheless extends his powers; — the sense of *smelling* is more contracted still; — and the *taste* and *touch* are the most confined of all. Thus man enjoys *very distant objects*, but with *one sense only*; more *nearly* he brings *two senses* at once to bear upon them; his sense of *smelling* affixes the *other two*, and at its own distance.

Each sense, however, the more enlarged its sphere, the more capable it is of making *combinations*; and is, consequently, the more *improveable*. Refined imaginations, and men of strong minds, take more pleasure, therefore, in improving the delights of the *distant senses*, than in enjoying such as are scarce capable of improvement.

By combining the *objects* of the *extensive senses*, all the

arts

arts of poetry, painting, and harmony, have been discovered; but the *closer senses*, if I may so call them, such as smelling, tasting, and touching, are, in some measure, as simple as they are limited, and admit of little variety. *The man of imagination* makes a great and an artificial happiness, by the pleasure of *altering* and *combining*; the *sensualist* just stops where he began, and cultivates only those pleasures which he cannot improve. *The sensualist* is contented with those enjoyments that are already made to his hand; but *the man of refined pleasure* is best pleased with happiness of his own creating.

SECT. XXII.

OF ANGER.

Anger, in its operation on the animal œconomy, is one of the strongest of the *mental stimuli*. It rouses the heart and arteries into greater action, produces an ardent glow over the whole body, but more especially in the face; the eyes look red, the voice is loud, and the muscular powers are increased: hence gout, palsy, &c. have been all removed by violent paroxysms of rage.

But this stimulus is usually too active in its operation to be friendly to health.

Where revenge cannot be indulged, a paleness of the skin and cheeks quickly succeeds, the voice falters, and the limbs are affected with tremor. But where the object is perpetually calling for resentment, and this passion is not consumed in violent action, it then gives tone to the muscular fibre.

Upon the British fleet coming into the Bay of *Hieres* (February 1744), our men, says Mr. Ives, understood that the enemy's fleet and ours were soon to engage.

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There appeared, not only in the *healthy*, but also in the *sick*, the highest mark of satisfaction and pleasure, and *these last mended surprisingly daily*, infomuch that on the 11th of February, the day we engaged the combined fleets of France and Spain, we had not above four or five but what were at their fighting quarters.

The Philadelphia militia who joined the remains of General *Washington's* army, in December 1776, and shared with them, a few days afterward, in the capture of a large body of *Hessians* at TRENTON, consisted of 1500 men, most of whom had been accustomed to the habits of a city life. These men slept in tents and barns, and sometimes in the open air, during the usual colds of December and January; and yet there were only two instances of sickness, and only one of death, in that body of men in the course of near six weeks, in those winter months. This *extraordinary healthiness* of so great a number of men, under such trying circumstances, can only be ascribed to the vigour infused into the body from the strong passions of the mind rendering it insensible to the ordinary causes of disease.

Militia officers and soldiers, who enjoyed good health

health during the campaign, were often affected by fevers and other disorders, as soon as they returned to their respective homes. I knew one instance, says Dr. RUSH, of a militia captain, who was seized with convulsions the first night he lay at ease, after having slept several months on a mattrass upon the ground. These affections appear to have been produced only by the sudden abstraction of that tone in the system which was excited by a sense of danger, and the other invigorating objects of a military life.

The patience, firmness, and magnanimity, with which the officers and soldiers of the American army endured the complicated evils of hunger, cold, and nakedness, can only be ascribed, continues this sagacious physician, to an insensibility of body, produced by an uncommon tone of mind, excited by the love of liberty and the hatred of the enemy: for the war was carried on by the Americans against a nation, to whom they had long been tied by the numerous obligations of consanguinity, laws, religion, commerce, language, interest, and a mutual sense of national glory; the *resentment* of the Americans rose of course, as is usual in all disputes, in proportion to the number

and force of these ancient bonds of affection and union. On this same principle it is, that savages, to satiate their revenge, bear with uncommon patience, and without injury, all the severities of cold and hunger, and have been known to wait even eight or ten months in ambush to destroy an adversary,

SECT. XXIII.

ON ENTHUSIASM.

It is well known that persons under strong prepossessions of mind, have exposed themselves* to extreme bodily tortures without expression of pain, and have also endured long fastings, the extremities of heat and cold, the infection of contagious distempers, and other hazardous experiments, without feeling the consequences that would most probably have taken place, had not the nervous feelings been more forcibly pre-occupied.

* *Hoffman. Affect. maniac. sensuum aug. stipat. Tolerantia inediae atque algoris mirabilia. Boerhaavii Aphorism. 1120.*

SECT.

SECT. XXIV.

OF LOVE.

Love, the most universal and grateful passion of human nature, which, in general, neither assumes the violence of *anger*, nor sinks into the depression of *grief*, may be considered as a *temperate stimulus*; but in its vicissitudes and extremes, it may acquire the impetuosity of the *first*, or the despondency of the *latter*.

In *love*, in *propitious love*, the heart beats with joy; vivacity cheers the countenance, the eye is brilliant, society is courted, language is animated, and vigour augmented.

But when this passion has taken deep possession of the heart and soul, with a *dubious*, or *adverse return*, it is expressed by deep involuntary sighs; every incident that excites emotion, especially the tender emotions of sympathy, make the heart palpitate, and suffuses the face with faint blushes; the voice is low, languid, slow, or faltering; the eyes are downcast or pensive; and the breast heaves and falls, like the motion of gently disturbed waters. Solitude, shades,

and evening walks, are frequented; objects of pity are cherished, and all the effusions of sentiment are tender, sedate, and sympathetic. The face at length becomes pale and wan, the eyes sink, the appetite for food is obliterated, and frightful dreams invade the tedious night.

SECT. XXV.

OF SOCIAL AFFECTION.

THIS is the mildest and most agreeable of all the mental stimuli.

SWEET is the breath of morn, her rising sweet,
with charm of earliest birds: pleasant the sun,
when first on this delightful land he spreads
his orient beams, on herb, tree, fruit, and flow'r,
glist'ning with dew: fragrant the fertile earth
after soft show'rs; and sweet the coming on
of grateful evening mild: then silent night,
with this her solemn bird; and this fair moon,
and these the gems of heav'n, her starry train.

*But neither breath of morn, when she ascends
with charm of earliest birds: nor herb, fruit, flow'r,
glist'ning with dew: nor fragrance after show'rs:
nor grateful evening mild: nor silent night,
with this her solemn bird: nor walk by noon;
or glitt'ring star-light,—WITHOUT THERE is sweet.*

MILTON.

SECT.

SECT. XXVI.

OF VIRTUE.

VIRTUE, the strength and beauty of the soul,
 it pleases and it lasts:—a *happiness*
 that even above the smiles and frowns of fate
 exalts great Nature's favourites: a *wealth*
 that ne'er encumbers, nor to baser hands
 can be transferr'd: it is the only good
 man justly boasts of, or can call *his own*.
 Riches are oft by guilt and baseness earn'd;
 or dealt by chance, to shield a lucky knave,
 or throw a fairer sunshine on a fool.
 But for one end, one much-neglected use,
 are riches worth your care: (for Nature's wants
 are few, and without opulence supplied.)
 This noble end is, to produce *the soul*;
 to shew the virtues in their fairest light;
 to make humanity the minister
 of bounteous Providence; and teach the breast
 that *generous luxury* the good enjoy.
 Oh! blest of heav'n, whom not the languid songs
 of luxury, not the inviting bribes
 of fordid wealth, nor all the gaudy spoils
 of pageant honour can seduce to leave
 those ever-blooming sweets, which from the store
 of Nature fair imagination culls

to charm th' enliven'd soul ! *For him*, the spring
 distils her dews, and from the silken gem
 its lucid leaves unfolds : *for him*, the hand
 of Autumn tinges every fertile branch
 with blooming gold, and blushes like the morn.
 Each passing hour sheds tribute from her wings ;
 and still new beauties meet *his* lonely walk,
 and loves unselt attract him. Not a breeze
 flies o'er the meadow, not a cloud imbibes
 the setting sun's effulgence, not a strain
 from all the tenants of the warbling shade
 ascends, but whence *his bosom* can partake
 fresh pleasure, *unreproved*.—Or when lightnings fire
 the arch of heav'n, and thunders rock the ground ;
 when furious whirlwinds rend the howling air,
 and ocean, groaning from the lowest bed,
 heaves his tempestuous billows to the sky ;
 amid the mighty uproar, while below
 the nations tremble, he, *good man*, looks abroad,
 from some high cliff, superior, and enjoys
 the elemental war.

ARMSTRONG.

SECT.

SECT. XXVI.

OF HOPE.

THERE surely never was a greater number of cures ascribed to one person, than those, which were lately said to have been wrought in FRANCE upon the tomb of Abbé PARIS, the famous JANSENIST, with whose sanctity the people were so long deluded. The curing of the sick, giving hearing to the deaf, and sight to the blind, were every where talked of as the usual effects of that holy sepulchre. But what is more extraordinary; many of the miracles were immediately proved upon the spot, before judges of unquestioned integrity, attested by witnesses of credit and distinction, in a learned age, and on the most eminent theatre that is now in the world. Nor is this all: a relation of them was published and dispersed every where; nor were the Jesuits, though a learned body, supported by the civil magistrate, and determined enemies to those opinions, in whose favour the miracles were said to have been wrought, ever able distinctly to refute or detect them*.

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* This book was writ by Mons. MONTGERON, counsellor or judge of the parliament of Paris, a man of figure and character, who was also a martyr to

Where shall we find such a number of circumstances, agreeing to the corroboration of one fact? And what have we to oppose to such a cloud of witnesses, but the absolute

to the cause. There is another book in three volumes (called *Recueil des Miracles de l'Abbé PARIS*) giving an account of many of these miracles.

Many of the miracles of Abbé PARIS were proved immediately by witnesses before the officiality or bishop's court at Paris, under the eye of cardinal NOAILLES, whose character for integrity and capacity was never contested even by his enemies.

His successor in the archbishopric was an enemy to the JANSENISTS, and for that reason promoted to the see by the court. Yet 22 rectors or cures of Paris, with infinite earnestness, press him to examine those miracles, which they assert to be known to the whole world, and indisputably certain: but he wisely forbore.

The MOLINIST party had tried to discredit these miracles in one instance, that of Mademoiselle le FRANC. But, besides that their proceedings were in many respects the most irregular in the world, particularly in citing only a few of the JANSENISTS' witnesses, whom they tampered with: besides this I say, they soon found themselves overwhelmed by a cloud of new witnesses, one hundred and twenty in number, most of them persons of credit and substance in Paris, who gave oath for the miracle. This was accompanied with a solemn and earnest appeal to the parliament.

All who have been in France about that time have heard of the reputation of Mons. HERAUT, the *lieutenant de Police*, whose vigilance, penetration, activity, and extensive intelligence, have been much talked of. This magistrate, who by the nature of his office is almost absolute, was invested with full powers, on purpose to suppress or discredit these miracles; and he frequently seized immediately, and examined the witnesses and subjects of them: but never could reach any thing satisfactory against them.

In the case of Mademoiselle THIBAUT he sent the famous de SYLVA to examine her; whose evidence is very curious. The physician declares, that it was impossible she could have been so ill as was proved by witnesses; because

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absolute impossibility or miraculous nature of the events, which they relate? And this surely, in the eyes of all reasonable people, will alone be regarded as a *sufficient refutation*.

The siege of BREDA, in the year 1625, affords an instance of a cure, which, in the opinion of the other calumniaries, induced the cure of the other calumniaries. It was impossible she could, in so short a time, have recovered so perfectly as he found her. He reasoned, like a man of sense, from natural causes; but the opposite party told him, that the whole was a miracle, and that his evidence was the very best proof of it.

No less a man than the Duc de CHATILLON, a duke and peer of France, of the highest rank and family, gives evidence of a miraculous cure, performed upon a servant of his, who had lived several years in his house with a visible and palpable infirmity.

I shall conclude with observing, that no clergy are more celebrated for strictness of life and manners than the secular clergy of France, particularly the rectors or cures of Paris, who bear testimony to these cures.

The learning, genius, and probity of the gentlemen, and the austerity of the nuns of Port-royal, have been much celebrated all over Europe. Yet they all give evidence for a miracle, wrought on the niece of the famous PASCAL, whose sanctity of life, as well as extraordinary capacity, is well known. The famous RACINE gives an account of this miracle in his famous history of Port-royal, and fortifies it with all the proofs, which a multitude of nuns, priests, physicians, and men of the world, all of them of undoubted credit, could bestow upon it. Several men of letters, particularly the bishop of Tournay, thought this miracle so certain, as to employ it in the refutation of atheists and freethinkers. The queen-regent of France, who was extremely prejudiced against the Port-royal, sent *her own physician* to examine the miracle, who returned an *absolute convert*. In short, the supernatural cure was so incontestable, that it saved, for a time, that famous monastery from the ruin with which it was threatened by the Jesuits. Had it been a cheat, it had certainly been detected by such sagacious and powerful antagonists, and must have hastened the ruin of the contrivers.

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example

example almost equally striking. "That city, from a long siege, suffered all the miseries that fatigue, bad provisions, and distress of mind could bring on its inhabitants. Among other misfortunes the *scurvy* made its appearance, and carried off great numbers. This, added to the other calamities, induced the garrison to incline towards a surrender of the place, when the Prince of ORANGE, anxious to prevent its loss, and unable to relieve the garrison, contrived, however, to introduce letters addressed to the men, promising them the most speedy assistance. *These were accompanied with medicines against the scurvy, said to be of great price; but of still greater efficacy, many more were to be sent there. Three small vials of medicine were given to each physician. It was publicly given out, that three or four drops were sufficient to impart a healing virtue to a gallon of liquor.* We now displayed our wonder-working balsams. Nor even were the commanders let into the secret of the cheat upon the soldiers. They flocked in crouds about us, every one who had the *scurvy* soliciting that some part might be reserved for his use. Cheerfulness again appears in every countenance, and an *universal faith* prevails in the sovereign virtues of the remedies. The effect of this delusion was truly astonishing,

ing, for many were quickly and perfectly recovered. Such as had not moved their limbs for a month before, were seen walking the streets with their limbs sound, straight, and whole. They boasted of their cure by the PRINCE'S REMEDY, the motion of their joints being restored by simple friction with oil, and the belly now of itself performed its office, or at least with a small assistance from medicine. Many, who had declared that they had been rendered worse by all former remedies, recovered in a few days to their inexpressible joy, and the no less general surprise, by their taking what we affirmed to be their gracious PRINCE'S CURE. "This curious relation," adds Dr. LIND*, "would hardly perhaps gain credit, were it not in every respect consonant to the most accurate observations, and best attested descriptions of that disease. It is given us by an eye-witness, an author of great candour and veracity, who, as he informs us, wrote down every day the state of his patients, and seems more to be surprised with their unexpected recovery than he probably would have been, had he been better acquainted with the nature of this surprising malady. AN IMPORTANT LESSON IN PHYSIC," adds this excellent writer, "IS HENCE TO BE LEARNED, THE WONDERFUL AND POWERFUL INFLUENCE OF

* LIND on the Scurvy, p. 349.

THE PASSIONS OF THE MIND ON THE STATE AND DIS-
 ORDERS OF THE BODY. THIS IS TOO OFTEN OVER-
 LOOKED IN THE CURE OF DISORDERS, MANY OF
 WHICH ARE SOMETIMES ATTEMPTED BY THE SOLE
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 ING IN TO OUR ASSISTANCE THE STRONG POWERS OF
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 MON REMEDIES OFTEN PROVE WONDERFULLY suc-
 CESSFUL IN THE HANDS OF MEN NOT OF THE FACUL-
 TY, WHICH DO NOT ANSWER THE PURPOSE IN A
 TIMOROUS AND DISTRUSTFUL PATIENT."

SECT. XXVIII.

OF FEAR,

Occasioning Exertion of Mind.

IN chronic diseases, as in hysteria and hypochondriac patients, in persons afflicted with asthma, or with a fit of the gout, tooth-ach, ague, or rheumatism, I have known these several disorders suspended for a time, and often entirely cured, when the mind has been under the influence of fear, surprise, or roused to a fixed attention to some interesting object.

I have frequently observed delicate hysterical women, who, for many months, had seldom enjoyed one day's health, suddenly relieved from every complaint when a favourite child was attacked with a disease in which danger was apprehended, and they continued, in appearance, to be in perfect health during the whole course of the illness, and exhibited an unusual alertness in discharging their duty as nurses and as parents. But when they understood that the danger of the disease was over, their former complaints gradually returned, to their great surprise; for, from so complete a suspension of their complaints

plaints as they had lately enjoyed, and for so considerable a time, they believed themselves perfectly cured.

I have been also informed, from the best authority, that during the troubles in Scotland, in the years 1745 and 1746, hysterical and nervous disorders scarcely ever made their appearance.

A very remarkable instance of the influence the mind has upon disorders of the body occurred to the celebrated BOERHAAVE. A person fell down in an epileptic fit in the sight of the other patients. The effect of this operated so strongly, that great numbers of them became immediately affected in the same manner. The opinion of the great physician above mentioned was requested on this occasion. He judiciously reflected, that, as these fits were originally produced by an impression on the mind, that the most proper means of cure would be to eradicate these impressions by others still more powerful. He therefore directed *actual cauteries* to be prepared, and kept hot, in readiness to be applied to the person who should next be affected. *The consequence was, not one person was seized.*

A gentleman of great courage and honour, who had become valetudinary, and subject to the asthma, by long service in India, as an officer in the land forces, told me,

he was attacked with a severe fit of that disorder during their encampment, which usually lasted from ten to twelve days: that, upon the third or fourth day of his illness, when he could only breathe in an erect posture, and without motion, imagining that it was not in his power to move six yards to save his life, the alarm guns were fired for the whole line to turn out, because a party of the Mahrattas had broke into the camp; and fearing certain death if he remained in his tent, *he sprung out with an alacrity that amazed his attendants; instantly mounted his horse, and drew his sword with great ease, which the day before he could not move from its scabbard, though he had used his whole strength in the attempt.* From the instant of the alarm and surprise, the *debility* left him, together with the *asthma*; nor did the disorder return for some time after.

SECT. XXIX.

OF HABIT.

A PROPENSITY to acquire *habits*, and to act from them, when the original incentive has long since ceased, is a *general law* of the animal oeconomy, which though sometimes the source of evil, is in the great tenor of life productive of much good.

The savage may fast many hours and then feed voraciously, without suffering either by inanition or repletion: but they who, in civilized society, have acquired the *habit* of eating five times every day, cannot pass one meal, nor without impatience wait five minutes beyond the usual time of eating. In both, the appetite for food and the powers of digestion depend on *habit*.

In case of great mental excitement, a man may continue many days without repose; but if he has acquired the *habit* of sleeping at a certain hour, and for a certain length of time, sleepiness at that hour will return, and at the *accustomed* hours he will awake from sleep.

Both the desire for sleep, and the disposition to awake, may,

may, by *habit*, become as regular as the rising and the setting of the sun.

The same holds good with respect to evacuations. I had a nurse for my children, says the sagacious author of *the Guide to Health*, who was so perfectly satisfied of this, that she governed them by the clock, and in their earliest infancy taught them the vast influence of *habit*.

By abstraction of some of the necessary stimuli, as food, loss of blood, exhausting diseases, indolence; and protracted sleep, the irritable fibres, from being elastic and robust, and patient of labour, become flaccid, tender, and liable to be soon fatigued.

A generous diet, with the assistance of bark, chalybeates, cold bathing, and sufficient exercise, soon however restore the tone to the fibre. These several stimuli distribute, impact, condense, and accumulate energy to every part; and bracing up the animated fibre, make it tenacious of vitality.

But when the steel, and bark, and bathing, are left off, how is the impulse to the movements constituting health kept up?

Ans. The actions which these occasioned become associated with the other actions in the frame, and though a link or two in the chain of motions be removed, the

circle of motions will nevertheless proceed for a time in due order *. Thus when a child revolves some minutes on one foot, the spectra of ambient objects appear to circulate round him some time after he falls upon the ground. Thus the stomach feels squeamish, and the objects dance about, to those who are just come on shore after a long voyage. Thus the palpitation of the heart continues some time after the object of fear which occasioned it is removed. And thus the blush of shame, which is an excess of sensation, and the glow of anger, which is an excess of volition, continue some time, though the affected person finds, that those emotions were caused by mistaken facts, and even endeavours to extinguish their appearance. Besides, during this interval of increased action, the disease is baffled, and the fibre is invigorated, and the constitution being set to rights, naturally continues to go on well by means of the natural stimuli, which are sufficient for the purposes of the animal economy in a state of health.

Every part of the system is, as we have seen, under the influence of *habit*, and even the *mind* itself is not exempt from it.

* Dr. DARWIN.

Some

Some associated motions are governed by the will, as in playing the violin or flute, and the arts of turning, spinning, and of weaving.

Motions are easily associated, if they serve the purposes of life; but not if they go counter to natural combinations, as when the silver-smith, for the first time, attempts to inspire by his nostrils whilst he is blowing through his lips. Yet by frequent repetition the *habit* is obtained, and the consent of parts is effectually established. One combination, however, is so perfectly unnatural, that no one has yet been able to describe at the same time two circles in opposite directions, one with his foot, the other with his hand.

Some associated motions, although at first either voluntary or accidental, become at last wholly independent of volition. Thus it is, that by *habit* we acquire tricks.

Other associated motions are from the beginning independent of the will, such as the vital motions, and those which are established by disease.

The generous steed, once set in motion, no longer needs the whip and spur, nor yet the curb, unless it be to make a change, and either to quicken or retard his motions. And the rider himself, if he has been accustomed to travel on one road, may wholly occupy his

mind about a thousand speculations, or with intensity of thought, pursue one continued series of ideas; and yet, although he may often change his direction, never wander from his way.

All animals have their haunts and home-bush. Their first object of pursuit is *food*, and with regard to this they have all their haunts.

The sportsman knows where to look for the covey of partridges to-day, which yesterday he moved, whilst they were feeding in the stubble; and we have every reason to believe, that even birds of passage return annually to their accustomed spot.

The next object of pursuit to animals is some *safe retreat*, in which they may quietly repose, some hiding-place, in which to sleep. In the choice of a sequestered spot, it is probably accident which first determines them; but the choice once made, they *habitually* return to it, unless fear, or some motive more powerful than habit, determines them to change it.

When they are to pass from their place of rest in search of food, the choice of a path is not a matter of indifference, but it is influenced by *habit*. If one of the same species has passed before them, they follow in his

steps.

steps, and having once passed unmolested in this path, they tenaciously adhere to it.

Hares have their track, with which the poacher is well acquainted, for it is here he fixes up his snare. Sheep and horses have each their peculiar track; and it is well known that men will tread where men have trod before, insomuch that if a drunken clown makes a crooked path over a new ploughed field, the next who follows will inadvertently trace his footsteps; and, having once passed by a given track, men habitually resort to it again.

I have frequently remarked the force of *habit* in large companies, who dine together at a public table, for every man, even without intending it, returns to the same seat he occupied the day before.

And in a farmer's stable, or in his shed, his horses and his cows pertinaciously retain each one its peculiar place; and should it be occupied by some impertinent intruder, this will be a sufficient subject of contention.

In their friendships animals are governed by the force of *habit*, for any two which meet accidentally, at a time and place distant from each other, and supposing them not to be restrained by some more powerful influence, will immediately become associates.

If two horses, strangers to each other, travel together to a fair, although they should have formed an acquaintance only for ten minutes, they will find each other out among a thousand others, and will quickly come together.

Hence it is, that nature learns in a measure to provide for *habitual* drains, and usually feels burdened if these are intermitted. This observation extends to hæmorrhages, whether artificial, natural, or morbid; to perspiration; to ulcers; to issues; and in short to every other drain, as the expectoration of mucus, &c.

The *habits* acquired by the constitution depend on such nice circumstances, that when *one kind* of stimulus *ceases* to rouse the excitability into the necessary quantity of exertion, it is often sufficient to produce the desired effect, to *change* the stimulus for another *apparently* similar in quantity and quality.

An agreeable illustration of this is given us by the learned and elegant Dr. DARWIN. A little boy, who was tired with walking, begged of his papa to carry him. "Here," says the reverend divine, "*ride on my gold-headed cane;*" and the pleased child, putting it be-

twice

tween his legs, galloped away with delight, and complained no more of his fatigue.

Here the aid of another excitement, that of *pleasurable sensation*, superadded vigour to the exertion of *exhausted volition*; which could otherwise only have been excited by *additional pain*, as by the lash of slavery. Thus a person, who has dined fully, or is either fatigued in body, or tired with intellectual exertion, and therefore under a great disposition to sleep, will be recruited by *coffee*; and when the last fails, the more diffusive stimulus of *opium* will arouse him. Even after opium fails, and he is left heavy and oppressed by the same propensity to sleep, the tiding of some unforeseen *accident*, demanding his instant attention, will remove this inclination for a time.

A gentleman engaged in a literary composition, which required uninterrupted exertion of his mental faculties for more than 40 hours, was enabled to go through it by supporting himself in this manner. After dinner, commencing his business, he took a *glass of wine* every hour. Ten hours after he ate something *nourishing*, but sparing in quantity, and for some time kept his attention alive by means of *punch* not made too strong. When, however, he found himself at last nigh to be overcome
by

by sleep, he changed this stimuli for an *opiate*, and finished his business in 40 hours. He then took a *glass* of *wine*, and *conversed* five hours with his employer. The *succession* of stimuli in this case was first *food*, next the stimulus of *mental exertion*, then *wine*, then *food* varied, then *punch*, then *opium*, then *wine* again, and lastly *pleasurable conversation*.

Some years after that, says Dr. BROWN, I walked and wandered in all sorts of ground, in roads and out of them, over smooth and plain, and heathy and mountainous tracts, from four o'clock after mid-day to two o'clock the next day, with only an hour's rest, and one hearty meal at betwixt ten and eleven in the forenoon, when I was now within six miles of my destination. The hills over which I wandered in the course of the night are those called Lammer-Muir, situated betwixt East-Lothian and the Mers: the places I travelled between in this route were Edinburgh and Duns. In this great exertion I was sustained by different stimuli, which made me insensible to fatigue, the *succession of objects*, high *animal spirits*, and *love*. At the end of my long journey, finding myself among my friends, and the object of my affection, I had strength enough still remaining to *dance* with the latter.

The

The same may be observed with regard to medicines, when we wish to *increase* the tonic power of any stimulus we should *change* it, and thus *substitute* bitters for bark, and then recur again to bark or steel. Thus when wine ceases sufficiently to stimulate the constitution, opium or æther, in appropriate doses, supplies the defect; and the contrary. This is also observed in the effects of cathartic medicines, for when one loses its power, another apparently less efficacious will succeed.

An EXCEPTION to this Influence of Habit.

When the *first impression*, however, is *very strong*, and the *effect* produced *very violent*, a force or power *inferior* to the original one will produce the *same effect*.

Thus it has often been remarked, that if a person, unaccustomed to the use of purgatives, was to take at a dose 20 grains of aloes, the smartness of the operation would leave such a lasting impression, that an equal effect would afterwards be produced by one half, one fourth, or even one tenth, of the same quantity; whereas, had the original dose been only a grain and a half, it might have been necessary to increase it to ten or fifteen grains, to produce any the least effect.

To explain this curious and perplexing phenomenon, we must remind the reader, that the chain of associated

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actions

actions when weak, being broken, the constitution is easily disturbed. Thus when a person is beginning to learn the alphabet, or the multiplication table, the ideas first get associated in the order of the table; but should the young scholar skip over three or four steps, his recovery would be then impracticable. And, again, persons, by a strong emetic, have had their stomach rendered so irritable, that afterwards one twentieth of the first dose has proved a sufficient emetic. It is thus also that a sudden and strong terror makes a coward for life; and fits that have been brought on by fright, recur when even a less occasional cause should chance to present itself.

A black servant in the country, on going to his pantry in the hall, was suddenly shot at by a robber who lay lurking behind a screen. The family being alarmed, found the servant to all appearance dead. He passed nearly the whole night in fits, and ever after, whenever it thundered much, or he was surprised by a flash of lightning, he was sure to be thrown into fits.

In such cases perhaps the *fibre* is weakened, and the *constitution* or *temperament* is entirely changed; but of this more will be said when we come to treat on the Nature of Disease.

END OF THE SECOND VOLUME.